1SFC132081M0201 EN, Rev A

Softstarters Type PSTX30...PSTX370
Installation and commissioning manual

Power and productivity
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ABB

Original instruction

This is the Installation and commissioning manual for Softstarters Type PSTX30…PSTX370.

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Data can be changed without notice.

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The data contained in this manual is intended solely for the product description and is not to be deemed to be a statement of guaranteed properties. In the interests of our customers, we constantly seek to ensure that our products are developed to the latest technological standards. As a result, there may be some differences between the softstarter and the information in this manual.

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Read this first

Warning and saftey

Thank you for selecting this ABB PSTX softstarter. Carefully read and make sure that you understand all instructions before you mount, connect, configure the softstarter.

This manual is intended for installation and advanced usage of the PSTX softstarter. For quick and easy installation, see 1SFC132082M9901 - Softstarters Type PSTX30...PSTX370User Manual short form. The manual is available on ABB website.

When this manual refers toABB website: Select the link **Control Products**, continue to **Softstarters** and type in the specified reference in the search field.

- Only authorized and appropriately trained personnel are allowed to install and make the electrical connection of the softstarter in accordance with existing laws and regulations.

- Only authorized personnel are allowed to do service and repair on the softstarter.

- Unauthorized repair will effect the warranty.

- ABB personell have to obey the instructions in **ABB CISE 15.4**.

- This manual is a part of the PSTX softstarter. Always keep this manual available when working with the PSTX softstarter.

- Examine the softstarter and the package when you unpack your new PSTX softstarter. If there are damages, please contact the transportation company or the ABB reseller/office immediately.

- Do not lift the softstarter by the connection bars, as this can do damage to the softstarter.

Saftey notes

In this user manual, these symbols are used:

⚠ **CAUTION**

Caution symbol indicates the presence of a hazard which could result in personal injury.

⚠ **WARNING**

Warning symbol indicates the presence of a hazard which could result in damage to equipment or property.

ℹ **INFORMATION**

Information sign alerts the reader to relevant facts and conditions.

Modifications to data in this manual can be applied without notice.

General saftey information

⚠ **CAUTION**

Only authorized and appropriately trained personnel are allowed to install and make the electrical connection of the softstarter in accordance with existing laws and regulations.

⚠ **WARNING**

Examine the softstarter and the package when you unpack your new PSTX softstarter. If there are damages, please contact the transportation company or the ABB reseller/office immediately.

⚠ **WARNING**

Do not lift the softstarter by the connection bars, as this can damage the softstarter.

⚠ **WARNING**

Only authorized and appropriately trained service personnel are allowed to do service and repair on the softstarter. Note: unauthorized repair will effect the warranty.

Softstarters Type PSTX
Installation and commissioning manual

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1   Introduction

1

This chapter describes the softstarter documentation. It describes manuals and its chapters, releases, intended audience and it explains concepts.

1.1 Documentation for softstarter PSTX30...PSTX370

For the softstarter types PSTX30...PSTX370, the following manuals and catalogs are available:

1SFC132081M0201
This document. Installation and comissioning manual (English version). **See chapter 1.1.1 Installation and commissioning manual** more information.

1SFC132082M9901
Installation and comissioning manual - Short form. **See chapter 1.1.2 Installation and commissioning manual - Short form** for more information.

1SFC132009C0201
Catalog Softstarters Type PSTX and PSTB.

These documents are available online in PDF format. A printed version of the "Installation and comissioning - Short form" is included with the softstarter.

The following manuals will be available as online PDF-files:

Table 1   Languages

Document ID	Language	
1SFC132081M1301	**AR**	Arabic
1SFC132081M2001	**ZH**	Chinese
1SFC132081M4601	**CS**	Czech
1SFC132081M0101	**DE**	German
1SFC132081M0201	**EN**	English
1SFC132081M0701	**ES**	Spanish
1SFC132081M1801	**FI**	Finnish
1SFC132081M0301	**FR**	French
1SFC132081M0901	**IT**	Italian
1SFC132081M3101	**NL**	Dutch
1SFC132081M4001	**PL**	Polish
1SFC132081M1601	**PT**	Portuguese
1SFC132081M1101	**RU**	Russian
1SFC132081M3401	**SV**	Swedish
1SFC132081M1901	**TR**	Turkish

These documents will be found at: ABB Website. Select the link Control Products on the site, and then continue to Softstarters.

1.1.1 Installation and commissioning manual

This manual, "Softstarters Type PSTX30...PSTX370 Installation and comissioning manual", contains instructions on how to install, commission and maintain the softstarter. It covers procedures for mechanical and electrical installation, and installation of communication devices. It also covers energizing, settings and configuration.

To start quickly, read **chapter 2 Quick start** or use the short form manual (1SFC132082M9901). For chapter content, see **Table 2 Chapter contents** below:

Table 2   Chapters contents

Chapters	Description
1. Introduction	Introduces the reader to this manual.
2. Quick start	Contains information on how to, in the quickest way, install the softstarter and get it into operation.
3. Description	Describes the softstarter with specifications and list of functions.
4. Mounting	Contains information of the delivery, how to unpack and mount the softstarter.
5. Connection	Contains instructions on how to make the electrical connections, as well as connections for communication devices.
6. Human-Machine Interface	Describes the local Human-Machine Interface, how it works and what it contains. Describes all settings and how to navigate the menu systems.
7. Functions	Describes all functions included in the softstarter, with their minimum, maximum and default values. This chapter is intended for the experienced user.
8. Communication	Describes the communication ports of the softstarter.
9. Maintenance	Describes what maintenance is needed and how to do it.
10. Troubleshooting	Contains instructions on how to quickly find and correct the most common faults.
11. Wiring diagrams	Contains electrical and application diagrams for the softstarter.
12. Revision	Shows all revisions of the manual
13. Index	Index of the content of this manual.

1.1.2 Installation and commissioning manual - Short form

The "Softstarters Type PSTX30...PSTX370 Installation and comissioning manual - Short form" contains brief information about the softstarter:

-Installation
-Electrical connections
-Basic funtions
-Troubleshooting

The short form contains the languages shown in **Table 1 Languages**. The short form has document ID 1SFC132082M9901.

1.2 Intended audience

1.2.1 General

The Installation and commissioning manual is intended for authorized installation, commissioning, and maintenance personnel.

1.2.2 Requirements for personnel

The installation personnel must have a basic knowledge in handling electric equipment. The commissioning and maintenance personnel must be well experienced in using electric equipment. ABB personell have to obey the instructions in **ABB CISE 15.4**.

1.3 Revision notes and other documents

For latest information on revisions and other documents related to the PSTX softstarters, please check ABB Website. Select the link Control Products on the site, and then continue to Softstarters.

1.4 Acronyms and abbreviations

The acronyms and abbreviations described in table 3 are used in this manual.

Table 3 Acronyms and abbreviations

Acronym/ abbreviation	Description
BP	By-pass
DOL	Direct-on-line
EOL	Electronic overload
FB	Fieldbus
FBP	Fieldbus Plug
HMI	Human-Machine Interface
I_e	Rated operational current
IT	Information Technology
LED	Light Emitting Diode
PCBA	Printed Circuit Board Assembly
PLC	Programmable Logic Controller
PTC	Positive Temperature Coefficient
SC	Short Circuit
SCR	Silicon Controlled Rectifier (thyristor)
TOR	Top of Ramp (full voltage/Full-On)
U_c	Rated control circuit voltage, used for controlling the softstarter. *
U_e	Rated operational voltage on the motor (three phase main voltage feeding the motor). *
U_s	Rated control supply voltage, feeding the electronics in the softstarter. *

*) For definition see IEC 60947-1 edition 5.0

2 Quick start

2

This chapter is a short guide on how to connect, configure and start the softstarter in an easy way.

This product has been carefully manufactured and tested, but there is a risk that damage can occur from abnormal handling during transportation. Therefore, the instructions below must be followed:

⚡ CAUTION

Hazardous voltage: Can cause death or serious injury. Always turn off and lock out all power that supply this device before you start to work on the equipment.

⚠ WARNING!

Mounting and fastening of electrical connections must be made by authorized personnel and in accordance with existing laws and regulations.

⚠ WARNING!

Before you connect the softstarters PSTX30... PSTX170 to operational voltage for the first time, apply control supply voltage in order to open the by-pass relays. (see step 6 in chapter 2.1 Connection). Opening the by-pass relays is necessary to avoid unintentional starting of the equipment while it is being connected to operational voltage.

ℹ INFORMATION

ABB personell have to obey the instructions in ABB CISE 15.4.

2.1   Connection

1.   Mount the softstarter according to **chapter 4 Mounting.**

ℹ INFORMATION

PSTX softstarters can be connected both In Line ❶ and Inside Delta ❷, **see Figure 1.**

2.   Connect the main circuit: terminals 1L1 - 3L2 - 5L3 to the line side ❶, and terminals 2T1 - 4T2 - 6T3 to the motor side ❷, **see Figure 2.** Use wire connection for PSTX30-105, **see Figure 2** and terminal connection for PSTX 142-370, **see Figure 3**.

3.   Connect the line side to terminals 1L1, 3L2, 5L3. see ❶ **Figure 2** and **3.** Connect the motor to terminals 2T1, 4T2, 6T3 on the motor side, see ❷ **Figure 2** and **3**

ℹ INFORMATION

Use only wires of the same dimension when you connect 2 wires to each terminal. (Possible for PSTX30...105 only).
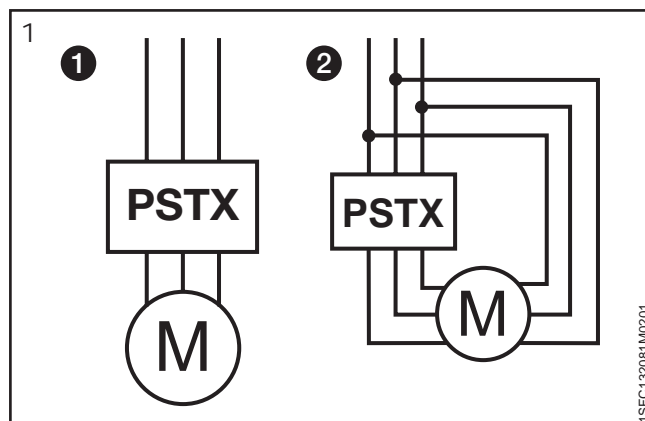

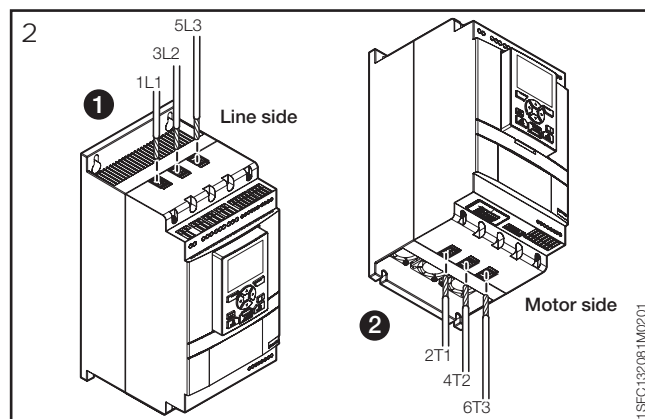Figure 1: In Line (1) and Inside Delta (2) connection

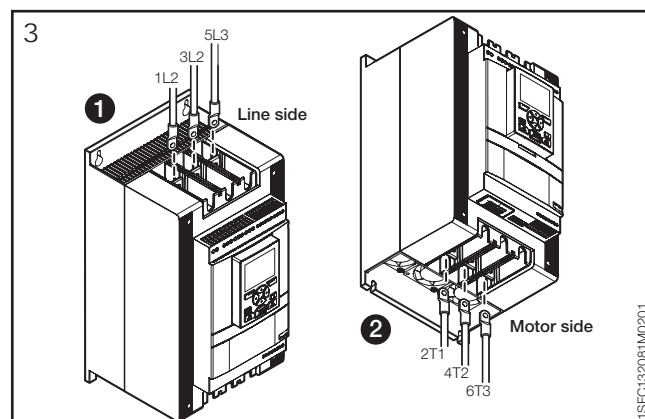Figure 2: Terminal connection clamps.

Figure 3: Terminal connection bars

4. Connect the control supply voltage (100-250V 50/60Hz) to terminal 1 and 2 .

5. Connect the functional earth (terminal 22), to an earthing point close to the softstarter. **See Figure 4.**

| i | The earthing is not a protective earth, it is a functional earth. The earthing cable should be as short as possible. Maximum length is 0.5 m. The earthing cable should be connected to the mounting plate were the softstarter is mounted, which should also be earthed.

6. Look at the diagram, **see Figure 5**, and connect the start/stop circuits: terminal 13, 14, 18, 19 and 20/21, with the internal 24V DC terminal. When using internal 24 V DC (terminals 20 or 21), the terminals 18 and 19 should be connected to each other. For external control circuit voltage, see chapter **5.1.2.3 Start and Stop - terminals 13, 14, 18, 19, 20, 21.**

⚠️ **WARNING**

Use 24V DC only when you connect terminal 13, 14, 15, 16 and 17. Other voltages can cause damage to the softstarter and the warranty will no longer be valid. For more information about terminal 15, 16 and 17, see chapter **5.1.2.4 Programmable inputs - terminals 15, 16 and 17.**

7. Connect terminals 4, 5, 6, 7, 8, 9, 10, 11 and 12 to use the signal output relays. These are potential free contacts for maximum 250 V AC, 1.5 A AC-15 and 30 V DC, 5 A DC-12. **See Figure 6.**

8. Check that the operational voltage and control supply voltage corresponds to the softstarter ratings.

9. Switch on the control supply voltage.

10. The green "Ready" LED will flash on the HMI, as in **Figure 7.**

11. After switching on the softstarter the language settings will appear on the display, choose your language and press selection softkey "OK". The HMI will now download language data from the softstarter. Which may take several minutes. When this is completed the HMI will switch to Home view.

12. Configure applicable parameters as given in **chapter 7 Functions** or use the assistants as described in **chapter 2.2 Configuration**.
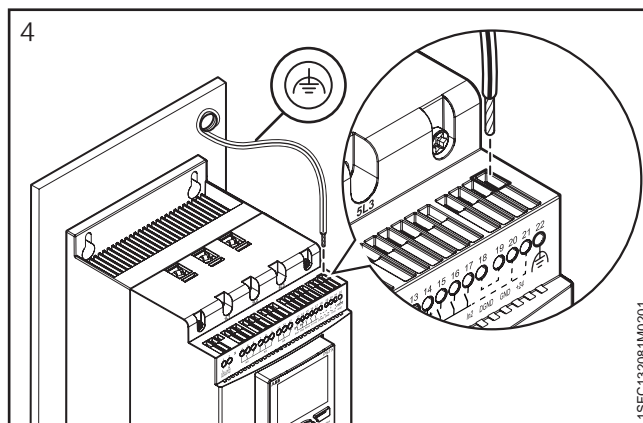

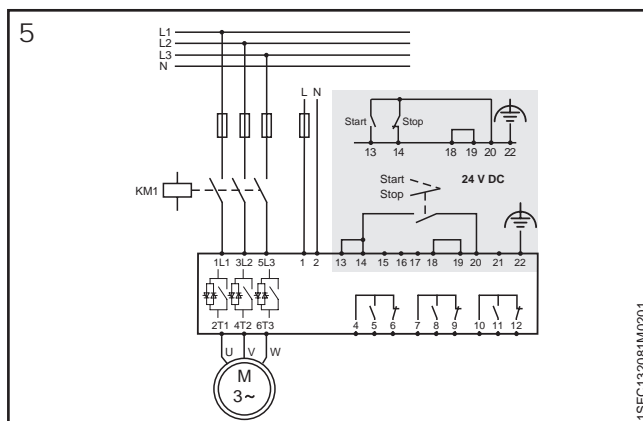Figure 4: Functional earth, terminal 22.

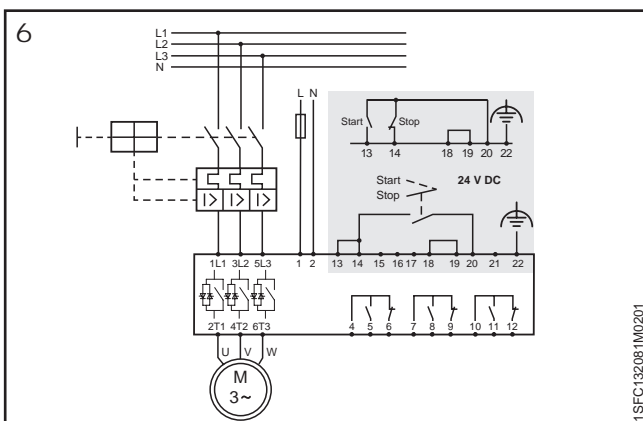Figure 5: Circuit diagram PSTX30...PSTX370 (Fuse and contactor version)
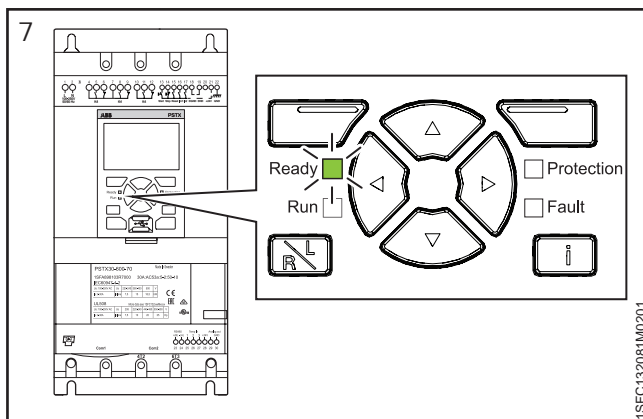

Figure 6: Circuit diagram PSTX30...PSTX370 (MCCB version)

Figure 7: Flashing "Ready" LED

2.2 Configuration

For a quick configuration of the softstarter, you can use the Assistants menu.

The Assistants menues are divided into:

- **Basic set-up**
  - The Basic set-up menu is divided into four steps:
  1. Language
  2. Date and time
  3. Motor data
  4. System configuration

- **Application set-up**
  - The Application set-up is divided into three steps:
  1. Application set-up
  2. Keep/Change values
  3. Tune settings

2.2.1 Basic set-up

This set-up will automatically appear when you start the softstarter. It can be turned off so that it does not start automatically. See step 6 below.

1. Find the Assistants menu by pressing ⬜ "Menu" and then scroll to Assistants with the Navigation keys. Press ⬜ "Select" to enter the Assistants menu.

2. Scroll to the Basic set-up menu by using the Navigation keys and then enter the menu by pressing ⬜ "Select".

3. The Basic set-up will start with step 1, Language. Press ⬜ "Edit" to change language. Use the Navigation keys to select language and then press ⬜ "Save".

4. Press ◈ to enter step 2, Date and time. Press ⬜ "Edit" and use the Navigation keys to edit date and time, then press ⬜ "Save".

5. Press ◈ to enter step 3, Motor data. Press ⬜ "Edit" to change the Motor rated current Ie. Use the Navigation keys to change the value and then press ⬜ "Save".

6. Press ◈ to enter step 4, System configuration. Here it is possible to set if the softstarter shall enter the Basic set-up at power on or not. Use the Navigation keys to select Yes or No and then press ⬜ "Save".

7. Press ◈ and then Press ⬜ "Done" to finish the Basic setup. For more settings, enter Application set-up.

2.2.2 Application set-up

1. Find the Assistants menu from the Home view by pressing ⬜ "Menu" and scroll to Assistants with the Navigation keys. Press ⬜ "Select" to enter the Assistants menu.

2. Scroll to the Application set-up menu by using the Navigation keys and then enter the menu by pressing ⬜ "Select".

3. The Application set-up will start with step 1, Application type. Scroll to the appropriate application type and then press ⬜ "Select". For a full Application list **see chapter 7.21.1 Application settings list.**

4. Press ◈ to enter step 2, Values. You can choose to "Keep actual values" or "Change to recommended values". Scroll to the selection of your choice and Press ⬜ "Select" to apply.

⚠ **WARNING!**

Note that previously saved parameter values will be lost if you select "Change to recommended values".

5. Press ◈ to enter step 3, Tune settings. In most cases the recommended values work well, but sometimes fine tuning is needed. For fine tuning, press ⬜ "Edit" and then use the navigation keys to set:
   - Start ramp time: 1 - 120s
   - Stop ramp time: 1 - 120s
   - Start ramp initial level: 10 - 99%
   - Stop ramp end level: 10 - 99%
   - Current limit level: 1.5 - 7.5 x I_e
   - Start mode: Voltage ramp, Torque ramp or Full voltage start
   - Stop mode: No ramp, Voltage ramp, Torque ramp, DC brake or Soft brake

6. Press ◈ and then press ⬜ "Done" to finish the Application set-up. If needed, fine tuning can also be made in the Parameters menu.

2.3 How to start/stop the motor

⚠ **CAUTION**

Hazardous voltage: Can cause death or serious injury. Turn off and lock out all power that supply this device before you start work on the equipment.

⚠ **WARNING!**

Mounting and fastening of electrical connections must be made by authorized personnel and in accordance with existing laws and regulations.

⚠ **WARNING!**

Before you connect the softstarters PSTX30... PSTX170 to operational voltage for the first time, apply control supply voltage in order to open the by-pass relays. (see step 6 in chapter 2.1 Connection). Opening the by-pass relays is necessary to avoid unintentional starting of the equipment while it is being connected to operational voltage.

ℹ **INFORMATION**

ABB personell have to obey the instructions in ABB CISE 15.4.

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1. Switch on the operational voltage.

2. To start the softstarter from the keypad, press the R/L-key to select local control, then press the Start key. Press Stop to stop the softstarter

3. To start from hard wire control, press the R/L-key to select hard wire control, then press the Start key. Press Stop to stop the softstarter

3   Description

3

This chapter describes the softstarter in general, specifications as well as available accessories and spare parts.

3.1 Overview

The PSTX softstarter is designed with the latest technology for soft start and soft stop of squirrel cage motors. The softstarter has several advanced motor protection features as standard.

Bypass

Softstarter range PSTX30...370 have integrated by-pass components. For PSTX210...370, this is a three phase by-pass contactor. In an emergency case, it is possible to start the motor DOL with this contactor.

User interface

The keypad on the front is designed with Navigation keys, Selection softkeys, Start and Stop keys, Local or Remote key, Information key and a clear information display. It is possible to choose between 15 different user languages.

The softstarter can be controlled in three different ways:

- Hardwire inputs control

- Keypad control (either attached to the softstarter front or detached and connected with the cable included)

- Fieldbus communication interface (by built in Modbus, Anybus module or the FieldBusPlug with adapter)

Only one type of control method can be enabled simultaneously. Default selection is hardware inputs control.

> **i** Keypad control has the highest priority and overrides all other control methods.

Fans

The integrated fans for cooling are running only during ramping (start/stop) and when the heat sink temperature is above a certain level. The temperature is monitored by a thermistor.

3.1.1 Operation functions

Available functions are listed below:

- Voltage ramp start

- Voltage ramp stop

- Torque ramp start

- Torque ramp stop

- Full voltage start

- Direct stop

- Stand still brake

- Normal current limit

- Dual current limit

- Ramp current limit

- Kick start

- Slow speed

- Motor heating

- Sequence start

- Automatic restart

- Small motor mode

- Fire mode

- Limp mode

- Pump cleaning

3.1.2 Protection functions

The PSTX softstarter is equipped with a number of protection functions to protect the softstarter, motor and other equipments. All protections can be set to have automatic reset or manual reset. Protection can be enabled or disabled by the user.

Available protections are listed below:

- EOL protection

- Locked rotor protection

- Phase reversal protection

- Current imbalance protection

- Over voltage protection

- Under voltage protection

- Earth fault protection

- Voltage imbalance protection

- Voltage outputs protection

- External thermal sensor - PT100 protection

- External thermal sensor - PTC protection

- Power factor underload protection

- Current underload protection

- User defined protection

- Too long current limit protection

- By-pass open protection

- Fieldbus failure protection

- Extension IO failure protection

- HMI failure protection

- Limit number of starts

3.1.2.1 User defined protection

Programmable digital input can be used in combination with external device/sensor to provide to the customer the possibility of handling own defined protection.
The protection is activated when the input signal reaches high level (fieldbus or physical I/O).

3.1.3 Warning functions

The softstarter is equipped with a number of warning functions that signal potential risks, before activating a protection.

The difference between a warning and a protection is that a warning can not stop the softstarter and that a reset of a warning is not necessary.

The warning level and other parameters needed to enable and configure the warning are settable. Warnings will be logged in the event list when it occurs.

Available warnings are listed below:

- Current imbalance warning
- Over voltage warning
- Under voltage warning
- EOL time-to-trip warning
- EOL warning
- Total Harmonic Distortion (THD) warning
- Voltage imbalance warning
- Power factor underload warning
- Current underload warning
- Faulty Fans warning
- Locked rotor warning
- Thyristor overload warning
- Short circuit warning

3.1.4 Fault detection functions

The softstarter is equipped with a number of fault detection functions to signal malfunctioning at softstarter, motor or power network level. The softstarter differentiates between external and internal faults. Fault detection functions can not be disabled by the user.

Available faults are listed below:

- Phase loss fault
- High current fault
- Low supply voltage fault
- Bad network fault
- Thyristor overload fault
- Short circuit fault
- Shunt fault
- Unspecified fault
- Heat sink overtemperarure fault
- Open circuit thyristor fault
- Faulty usage
- Faulty connection

3

3.1.5   Softstarter overview

Settings can be done via Keypad and Fieldbus communication.

With the keypad, settings can be set as individual parameter settings or as a selection of predefined parameters for different applications.
Most parameters have one possible setting, but some parameters have extra settings for sequence start. The default parameter settings are stored in the unit so that a reset to default can be done at any time.
When the fieldbus communication is selected, most parameters can also be modified from this interface.
Overview, **See Figure 8.**
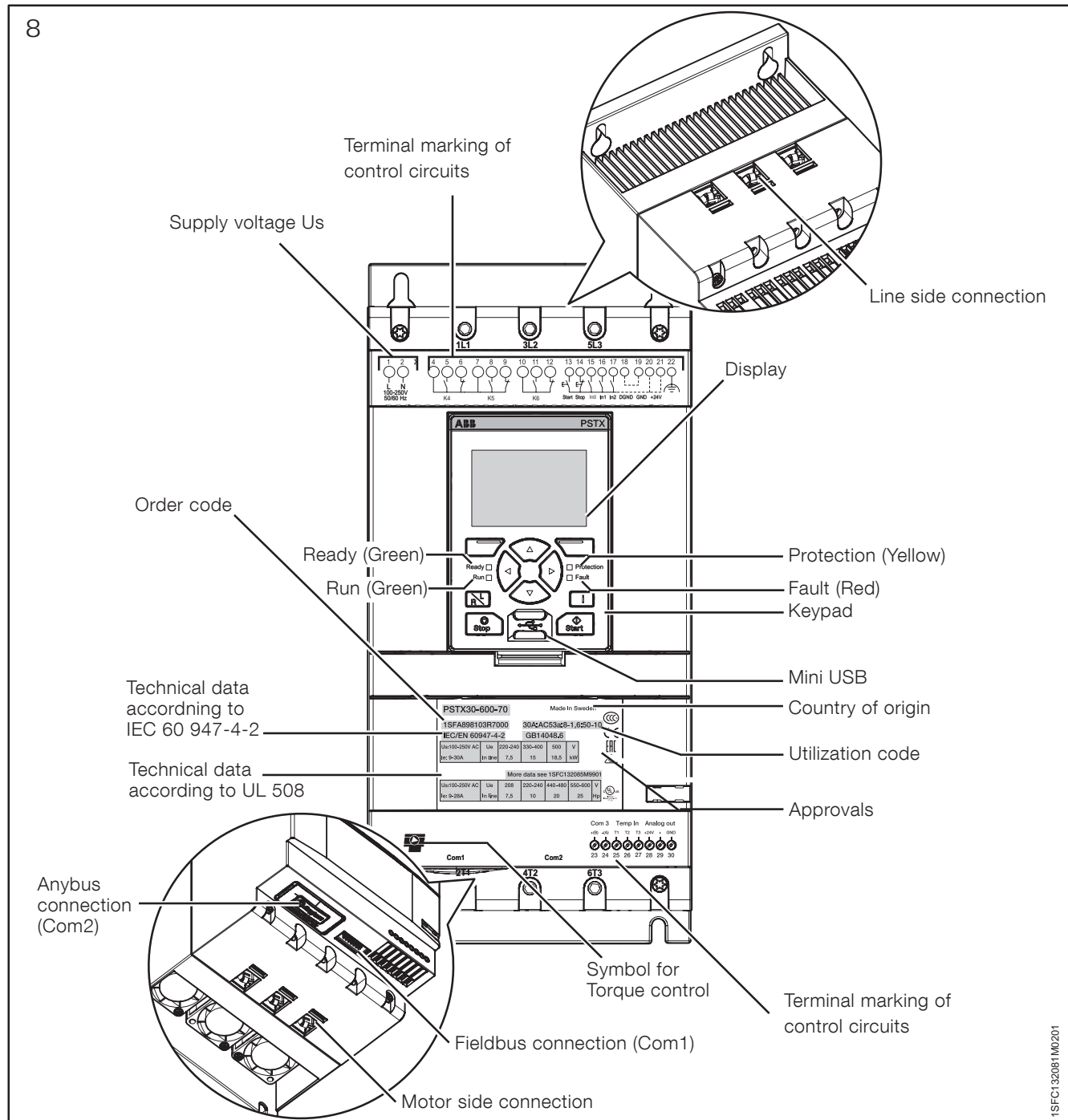
Figure. 8: Softstarter overview

3.1.6   Type designation

Table 1   Type designation (See Figure 9.)

Designation (i.e. PSTX370-600-70)	Desription
PSTX	Softstarter type
370	Current rating 370 = 370A
600	Main voltage 600 = 208 - 600V 50/60 Hz 690 = 400 - 690V 50/60 Hz
70	Supply Voltage 70 = 100 - 250V 50/60 Hz
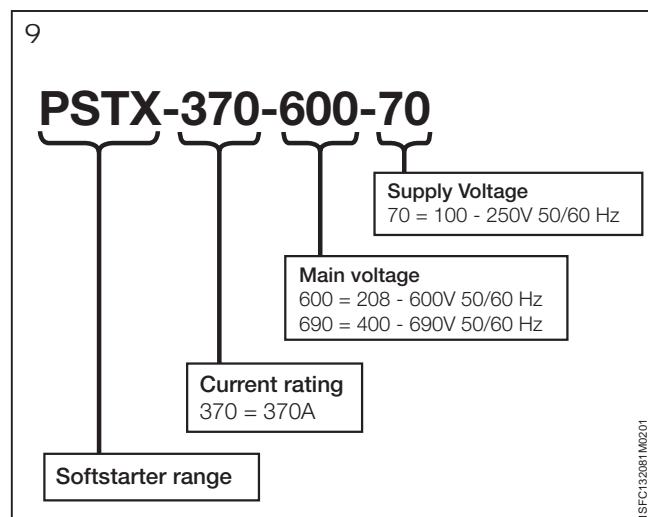
Figure. 9: Type designation

3.1.7   Environmental influence

The product is designed to minimize the environmental affects during manufacturing and use of the product. Most of the materials used are recyclable and shall be handled and recycled according to local laws.

Further information regarding used material and recycling of the product can be found at ABB Website.

3.1.8   Specifications

Table 2   Specifications

General data	Description	
Degree of protection: Main circuit	**PSTX30-105:** IP10	**PSTX142-370:** IP00
Degree of protection: Supply and control circuit	**PSTX30-105:** IP20	**PSTX142-370:** IP20
Operating position	Vertical at ± 30°	
Ambient temperature	**Storage:** -40 °C to +70 °C (-104 °F to 140 °F) **Operation:** -25 °C to +60 °C (-77°F to 104 °F) **De-rating:** + 40 °C to + 60 °C (104° F to 140° F) with derating 0,6%/1° C (0,33%/1grF)	
Altitude	1000 m (3281 ft.) above sea level without derating. 1000 - 4000 m (3281 - 13123 ft.) with derating 0,7%/100 m (0,22%/100ft)	
Pollution degree	3	
Relative humidity	5 - 95% (non condensing)	
Standards	IEC 60529 IEC 60947-1 IEC60947-4-2	
Standards UL	UL508	
PTC input	IEC 60947-8 Mark A detectors DIN 44081 and DIN 44082	
EMC	IEC 60947-4-2 Class A ❶	
Marine approvals	Contact your ABB sales office	

❶ The softstarter is designed for class A equipment. Use of the product in domestic environments can cause radio interference. If so, it can be necessary to use more mitigation procedures.

3

3.2 Technical data

3.2.1 General

Table 3 General

General data	Description
24 V output	24 V ± 5% Max 250 mA
Rated insulation voltage, U_i	600 V / 690 V
Rated operational voltage, U_e	208-600 / 690 V, 50 / 60 Hz
Rated supply voltage,U_s	100-250 V, 50 / 60 Hz
Voltage tolerance	+10% to -15%
Rated frequency	50 / 60 Hz
Frequency tolerances	± 10%
Rated impulse withstand voltage	6 kV Operation circuit 4 kV Control and supply circuit
Relay outputs	3 programmable
Number of controlled phases	3
Inputs	Start, stop, 3 programmable inputs (Digital I/O: In0, IN1, IN2), temperature sensor input.
Outputs	Relay outputs: K4 K5 K6.
Output relay preformance	250 V AC, Ith = 5A, I_e = 1.5A (AC-15)
Analog output	4-20 mA, 0-20 mA, 0-10 V, 0-10 mA
PTC input	2825 ohm ± 20% switch off resistance 1200 ohm ± 20% switch on resistance
Cooling system	Fan
Recommended fuse	6 A Delayed
Control supply circuit	MCB use C characteristics
Communication	3 Fieldbus ports, Extension I/O
Communication protocols	DeviceNet / Profibus DP / Modbus / EtherNET/IP / Modbus TCP

3.2.2 Technical data for external keypad

Table 4 Technical data for external keypad

Display	Display type
Status indicating LEDs	**Power on:** Green **Protection:** Yellow **Fault:** Red
Ambient temperature	**Storage:** -25 °C to +70 °C (-13 °F to 158 °F) **Operation:** -25 °C to +60 °C (-13 °F to 140 °F)
Degree of protection	IP66
UL approval	Type 1 Type 4X Type 12
Marine approvals	Contact your ABB sales office

3.2.3 Semi-conductor fuses

⚠️ **WARNING!**

Semiconductor fuses must be used to keep the warranty on the thyristors.

ℹ️ **INFORMATION**

To achive a type 2 coordination, semi conductor fuses must be used.

Table 5 Semiconductor fuses

Type	Ue (V)	I_e (A)	Bussman Knife Fuses (DIN43 620)		
			Size	A	Type
PSTX30	500-690	30	000	100	170M1567
PSTX37	500-690	37	000	125	170M1568
PSTX45	500-690	45	000	160	170M1569
PSTX60	500-690	60	000	160	170M1569
PSTX72	500-690	72	000	250	170M1571
PSTX85	500-690	85	000	315	170M1572
PSTX105	500-690	106	1*	400	170M3819
PSTX142	500-690	143	2	500	170M5810
PSTX170	500-690	171	2	630	170M5812
PSTX210	500-690	210	2	630	170M5812
PSTX250	500-690	250	2	700	170M5813
PSTX300	500-690	300	3	800	170M6812
PSTX370	500-690	370	3	900	170M6813
PSTX370	500	370	3	2000	170M6021
PSTX370	690	370	3	1600	170M6019

3.2.4 Weights

Table 6 Weights

Type	Weight in kg	Weight in lbs
PSTX 30...105	6,1	13,5
PSTX 142...170	9,6	21,2
PSTX 210...370	12,7	27,9

3.2.5 Softstarter ratings

PSTX30…370 Temp ≤ + 40 °C (104 oF), 4 * Ie in 10 sec.

IEC Softstarter type	Motor power when connected In Line				Motor power when connected Inside Delta				Rated current Ie	
	220-230V	380-400V	500V	690V	220-230V	380-400V	500V	690V	In Line	Inside Delta
	kW	kW	kW	kW	kW	kW	kW	kW	A	A
PSTX30-600-70	7,5	15	18,5		12,5	25	30		30	52
PSTX30-690-70		15	18,5	25		25	30	45	30	52
PSTX37-600-70	9	18,5	22		15	30	37		37	64
PSTX37-690-70		18,5	22	30		30	37	55	37	64
PSTX45-600-70	12,5	22	25		25	37	45		45	76
PSTX45-690-70		22	25	37		37	45	59	45	76
PSTX60-600-70	15	30	37		30	55	75		60	106
PSTX60-690-70		30	37	55		55	75	90	60	106
PSTX72-600-70	18,5	37	45		37	59	80		72	124
PSTX72-690-70		37	45	59		59	80	110	72	124
PSTX85-600-70	22	45	55		40	75	90		85	147
PSTX85-690-70		45	55	75		75	90	132	85	147
PSTX105-600-70	30	55	75		55	90	110		106	181
PSTX105-690-70		55	75	90		90	110	160	106	181
PSTX142-600-70	37	75	90		75	132	160		143	245
PSTX142-690-70		75	90	132		132	160	220	143	245
PSTX170-600-70	45	90	110		90	160	200		171	300
PSTX170-690-70		90	110	160		160	200	257	171	300
PSTX210-600-70	59	110	132		102	184	250		210	360
PSTX210-690-70		110	132	184		184	250	315	210	360
PSTX250-600-70	75	132	160		132	220	295		250	430
PSTX250-690-70		132	160	220		220	295	400	250	430
PSTX300-600-70	90	160	200		160	257	355		300	515
PSTX300-690-70		160	200	257		257	355	500	300	515
PSTX370-600-70	110	200	257		200	355	450		370	640
PSTX370-690-70		200	257	355		355	450	600	370	640

PSTX30…370 Temp ≤ + 40 °C (104 oF), 4 * Ie in 10 sec.

cULus Softstarter type	Motor power when connected In Line				Motor power when connected Inside Delta				Full load current Max FLA	
	208V	220-240V	440-480V	550-600V	208V	220-240V	440-480V	550-600V	In Line	Inside Delta
	hp	hp	hp	hp	hp	hp	hp	hp	A	A
PSTX30-600-70	7,5	10	20	25	10	15	30	40	28	48
PSTX30-690-70			20	25			30	40	28	48
PSTX37-600-70	10	10	25	30	15	20	40	50	34	58
PSTX37-690-70			25	30			40	50	34	58
PSTX45-600-70	10	15	30	40	20	25	50	60	42	72
PSTX45-690-70			30	40			50	60	42	72
PSTX60-600-70	20	20	40	50	30	40	75	100	60	103
PSTX60-690-70			40	50			75	100	60	103
PSTX72-600-70	20	25	50	60	30	40	75	100	68	117
PSTX72-690-70			50	60			75	100	68	117
PSTX85-600-70	25	30	60	75	40	50	100	125	80	138
PSTX85-690-70			60	75			100	125	80	138
PSTX105-600-70	30	40	75	100	60	60	150	150	104	180
PSTX105-690-70			75	100			150	150	104	180
PSTX142-600-70	40	50	100	125	75	75	150	200	130	225
PSTX142-690-70			100	125			150	200	130	225
PSTX170-600-70	50	60	125	150	75	100	200	250	169	292
PSTX170-690-70			125	150			200	250	169	292
PSTX210-600-70	60	75	150	200	100	125	250	300	192	332
PSTX210-690-70			150	200			250	300	192	332
PSTX250-600-70	75	100	200	250	150	150	350	450	248	429
PSTX250-690-70			200	250			350	450	248	429
PSTX300-600-70	100	100	250	300	150	200	450	500	302	523
PSTX300-690-70			250	300			450	500	302	523
PSTX370-600-70	125	150	300	350	200	250	500	600	361	625
PSTX370-690-70			300	350			500	600	361	625

3.2.6   Dimensions

PSTX 30...105 - **1SFB536268G1010**
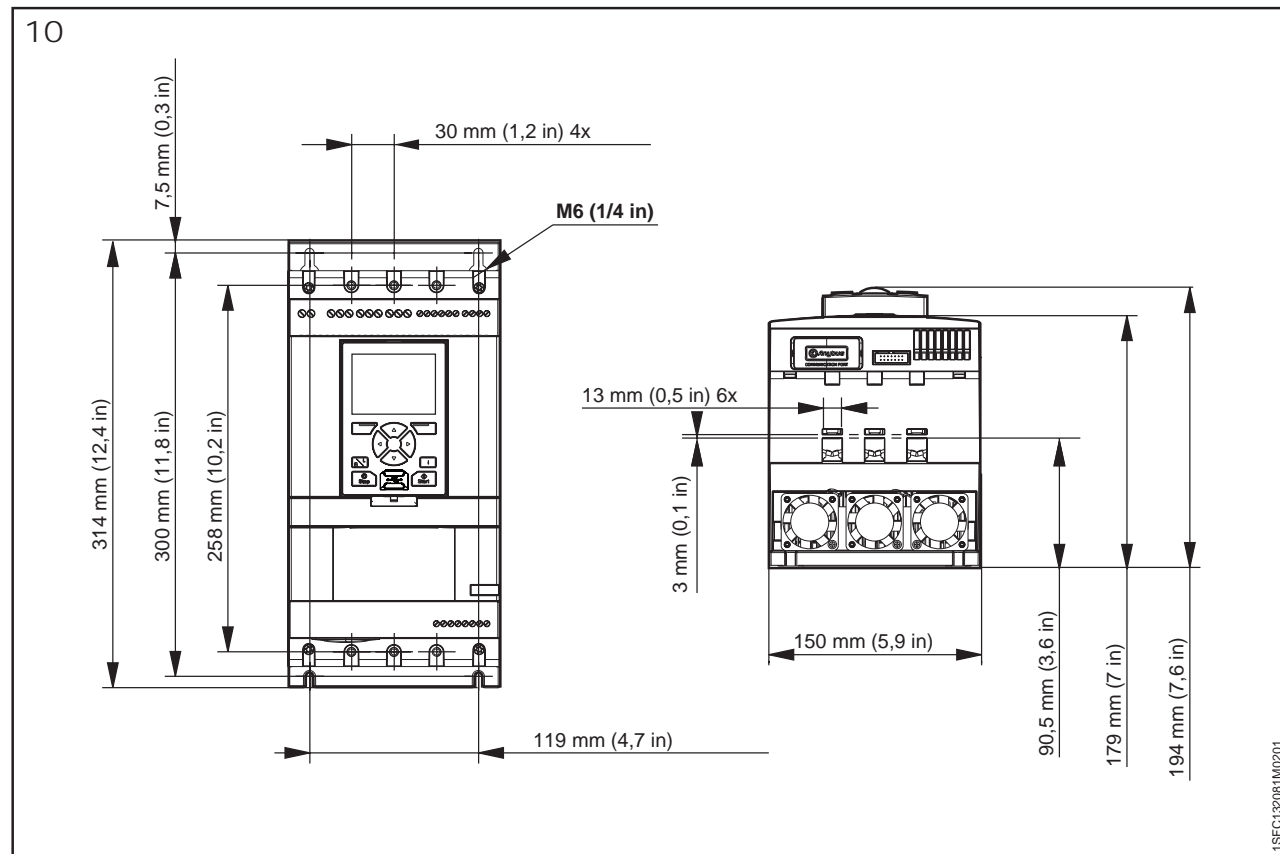
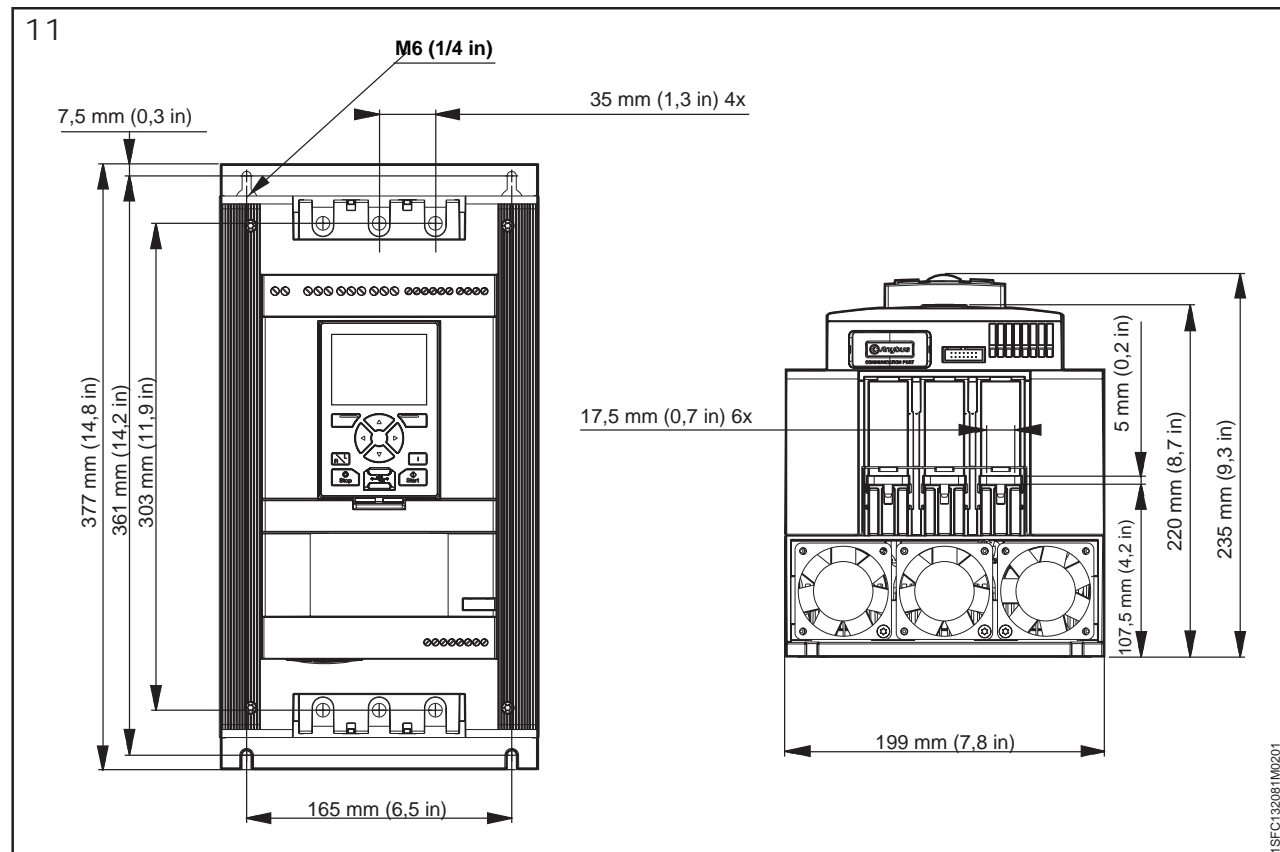Figure 10: Dimensions PSTX30...105

PSTX 142...170 - 1SFB536268G1011
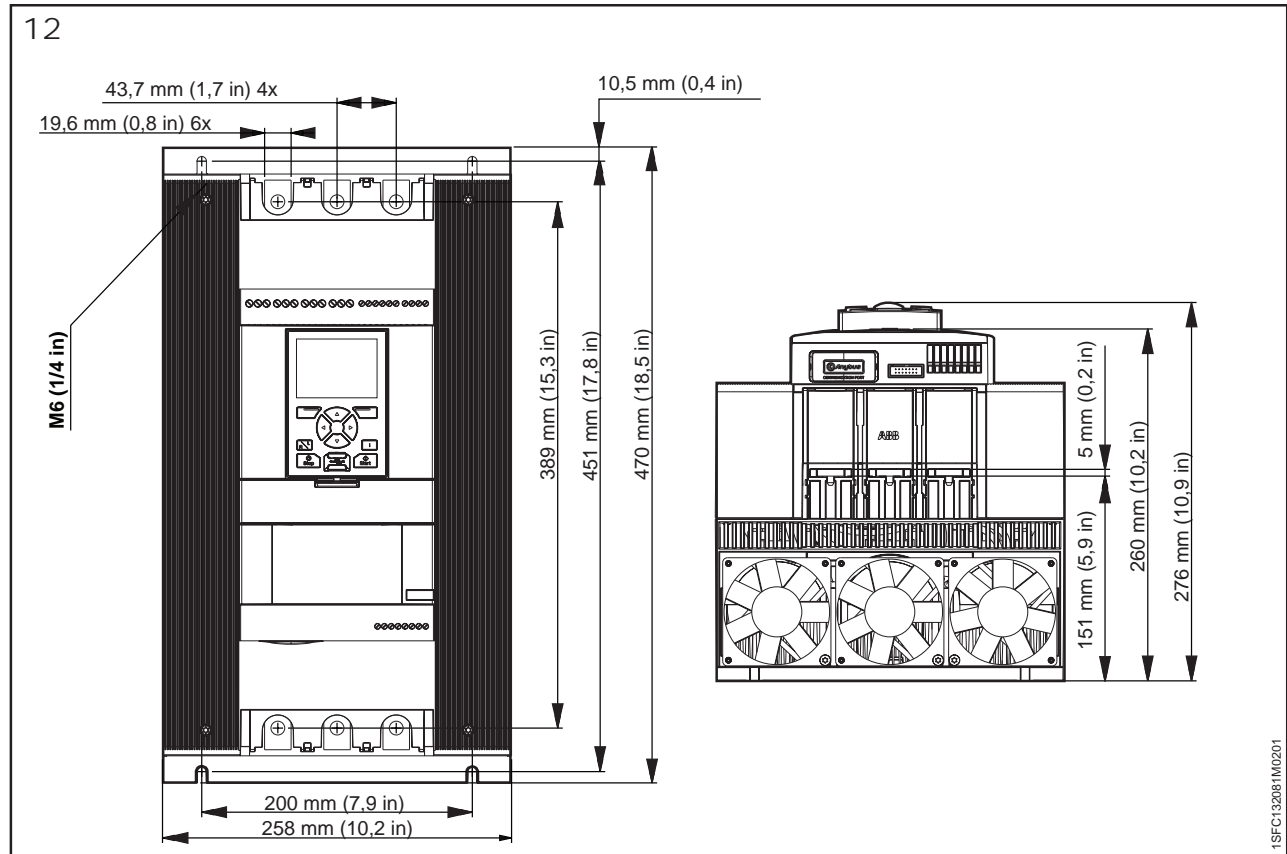

Figure 11: Dimensions PSTX142...170

PSTX 210...370 - 1SFB536268G1012

12

Figure 12: Dimensions PSTX210..370

1SFC132081M0201

4 Mounting

4

This chapter contains instructions on how to receive the softstarter and how to mount it in a proper way.

⚠️ **WARNING**

If you do not obey these instructions, it can cause the softstarter to become overheated or not operate correctly.

4.1   Receive, unpack and check

⚠️ **WARNING**

Do not lift the softstarter by the connection bars, as this can damage the softstarter.

⚠️ **WARNING**

Risk of damage to property. Make sure that no liquids, dust or conductive parts can go into the softstarter.

- Check that the package is placed with the correct side up, **see Figure 13.**

- Remove the transport casing.

- Check that the order code corresponds with the delivery documents.

- Check that all items are included, according to the delivery note. See **Table 1 Delivery note.**

- Check the softstarter as well as the packaging. In case of damages, please contact the transport company or the ABB reseller/Office immediately.

- Until the softstarter is mounted it should be stored in its packaging.
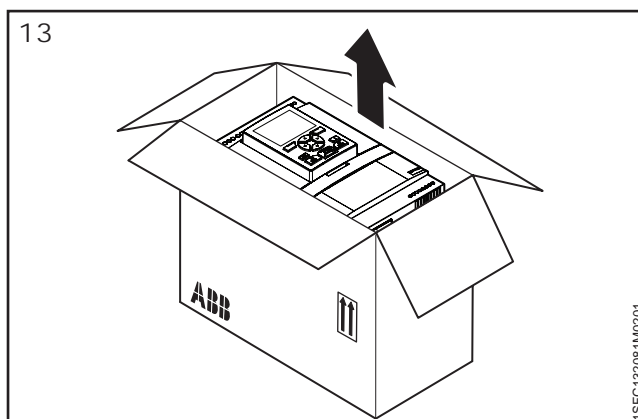
Figure 13: Receiving, unpacking and checking

Table 1   Delivery note

Softstarter type	Items included with the softstarter
PSTX30...105	• 1SFB262001D1000 – HMI Mounting Kit • 1SFC132082M9901 – PSTX Short Form Manual
PSTX142...170	• 1SFB262001D1000 – HMI Mounting Kit • 1SFC132082M9901 – PSTX Short Form Manual • 1SFA899221R1002 – Terminal Kit # PSLE-185
PSTX210...370	• 1SFB262001D1000 – HMI Mounting Kit • 1SFC132082M9901 – PSTX Short Form Manual • 1SFA899221R1003 – Terminal Kit # PSLE-300

4.2   Mount

The PSTX30...370 softstarters are available in three different physical sizes and all of them should be mounted with M6 bolts, or bolts with the same dimension and strength.

4.2.1   Handling when mounting

⚠️ **WARNING**

Do not lift the softstarter by the connection bars, as this can damage the softstarter.

PSTX30...370 can be taken out of the package and be mounted without lifting equipment. See **3.2.4 Weights** for weights.

4.2.2   Minimum distance to wall/front

ℹ️ Make sure that the distances to the surrounding walls are sufficient. For the minimum distance to front and wall, see **Figure 16** and **Table 2**.

⚠️ **WARNING**

Risk of damage to property. Ensure that no liquids, dust or conductive parts enter the softstarter.

⚠️ **WARNING**

If you do not obey these instructions, this can cause the softstarter to become overheated or not operate correctly.

To get suitable cooling, the softstarter has to be mounted vertically, and in such a way that the airways are not blocked, see **Figure 14.**

Table 2   Minimum distance to wall/front

Softstarter type	A (mm)	B (mm)	C (mm)	A (in)	B (in)	C (in)
PSTX30...105	100	10	35	3.94	0.39	1.38
PSTX142...170	100	10	35	3.94	0.39	1.38
PSTX210...370	100	10	35	3.94	0.39	1.38
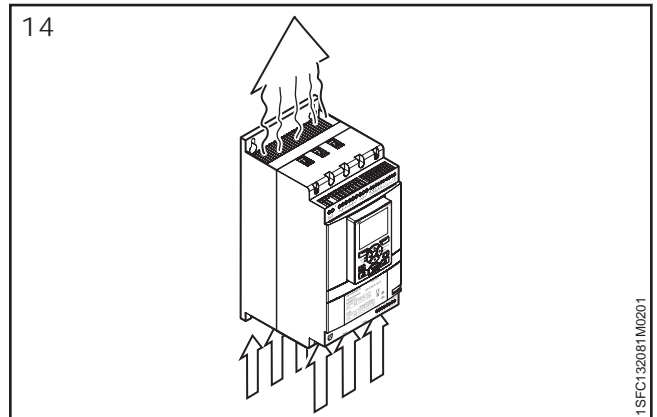
Figure 14: Flow of air for cooling purposes
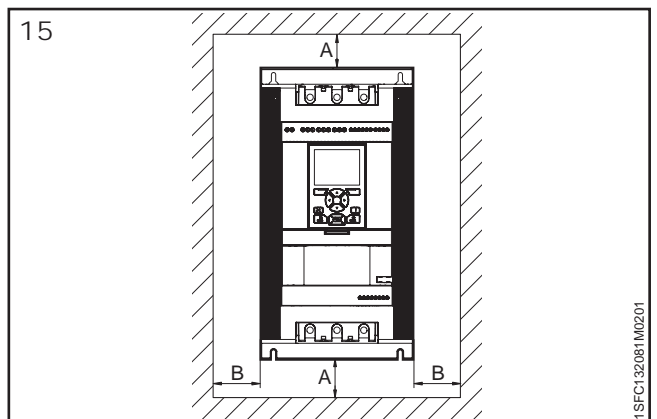
Figure 15: Minimum distances to wall.
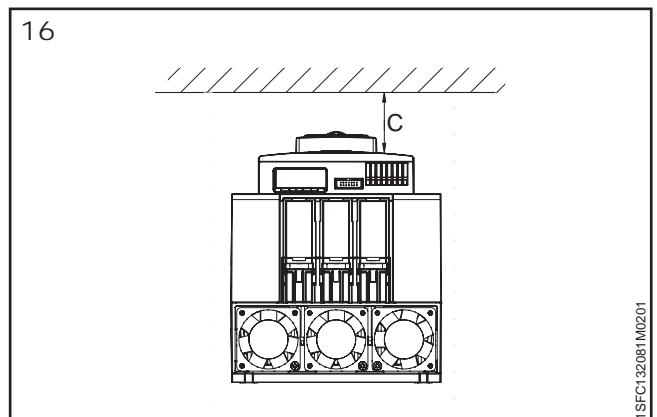
Figure 16: Minimum distances to front.

4.2.3 Minimum enclosure size

In applications where the softstarter is installed in an enclosure, the following minimum enclosure sizes are recommended. Sizes are according to **Figure 17.** And **Table 3 and 4.**

Table 3 Minimum enclosure size (IEC)

IEC	Minimum enclosure sizes		
Softstarter type	W (mm)	H (mm)	D (mm)
PSTX30...105	508	508	305
PSTX142...170	508	508	305
PSTX210...370	762	914	305

Table 4 Minimum enclosure size (UL)

c(UL)us	Minimum enclosure dimensions			
Softstarter type	W (in)	H (in)	D (in)	Min number of latches
PSTX30...105	20	20	10	2
PSTX142...170	20	20	12	2
PSTX210...370	30	24	12	7
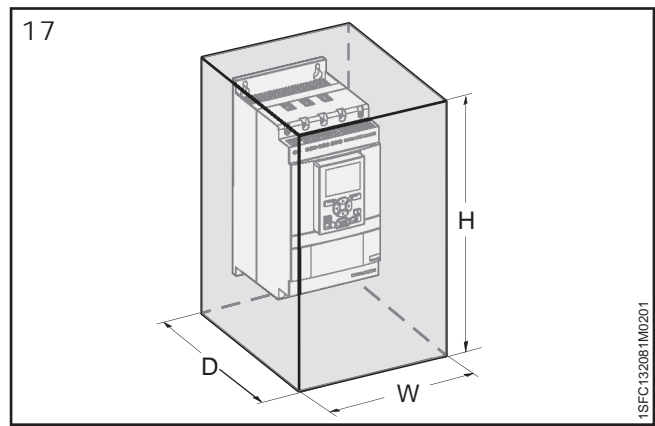
Figure 17: Minimum enclosure size.

4.2.4 Maximum mounting angle

ℹ️ Make sure that the distances to the surrounding walls are sufficient. The mounting angle shall be within specifications shown in **Figure 18.**

Maximum mounting angle for all PSTX softstarters is 30°, **see Figure 2.**

Figure 18: Maximum mounting angle.

4.2.5 Dimensions and drilling plan

For dimensions and drilling plan **see chapter 3.2.6 Dimensions.** Drilling plan is also printed on the box.

⚠️ **WARNING**

Risk of damage to property. Ensure that no liquids, drilling swarf, dust or conductive parts enter the softstarter.

⚠️ **WARNING**

Using a too small enclosure and/or not following the instructions in other ways may result in overheating of the softstarter and operational disturbances.
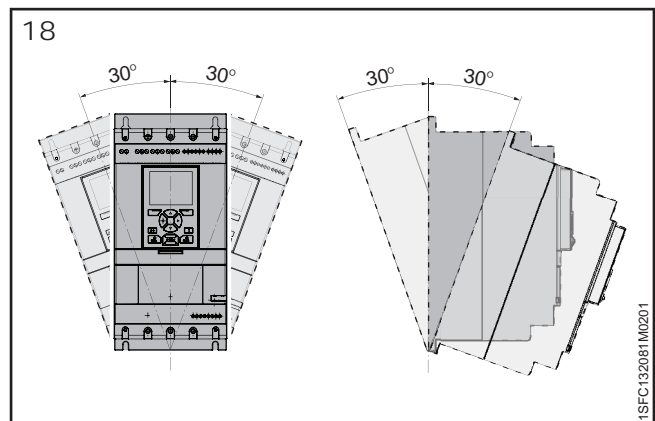
4.2.6 Detachable keypad

The PSTX keypad is detachable for i.e. door mounting. Connect the keypad with the included 3 meter cable managing both serial communication and power supply. The cable shall be connected to the network port on the front of the softstarter. Detach the keypad by pressing the lock with a screwdriver according to ❶ and ❷ in **Figure 19.**
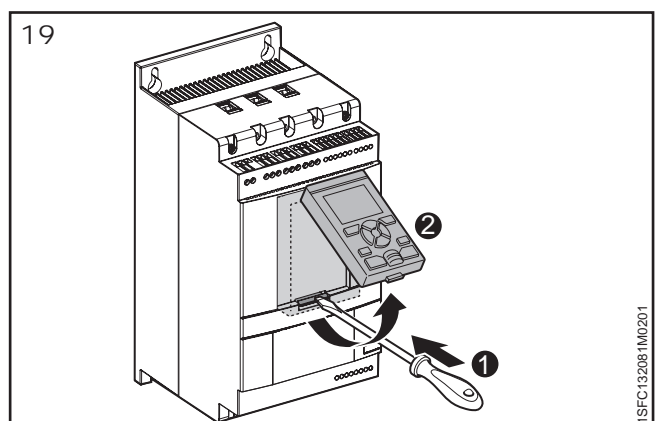
Figure. 19: Detach the keypad

4.2.6.1 Mounting Detachable HMI

ℹ️ A cable is included in the shipment, but it is also possible to use your own RJ45 network cable. The cable length should be max 3m long to minimize distortion of the communication.

ℹ️ The softstarter HMI is IP66 approved when mounted on the enclosure door.

The detachable HMI can also be used to copy parameters from one softstarter to another during commissioning (temporarily handheld).

Included with the softstarter comes:

• Rubber gasket

• Plastic screw-nut

• RJ45 Network cable

1. Remove the detachable HMI from the softstarter by unsnapping the plastic latch under the detachable HMI, see ❶ and ❷ in **Figure 20.**

2. Drill a hole were the detachable HMI is to be mounted. Maximum size of the hole is Ø26 (Ø 1.02"), see ❶ in **Figure 21.** Put the rubber packing around the threaded network connector on the detachable HMI, see ❷ in **Figure 21.** Press the the threaded network connector through the drilled hole.
See ❸ in **Figure 21.** Fasten the plastic screw-nut on the threaded network connector, with 2 Nm (17.7 lb/in).

3. Remove the RJ45 plug see ❹. Connect one end of the network cable to the network port on the front of the softstarter ❺ in **Figure 21.**

4. Connect the other end of the network cable to the network port on the back of the detachable HMI, see ❻ in **Figure 22.**

5. Make sure that the network cable is properly inserted into both ports. Roll the rest of the hanging cable so it will not get clamped by the door, see ❼ in **Figure 23.** Close the door of the enclosure and switch on the operational voltage to control that the external HMI is working.
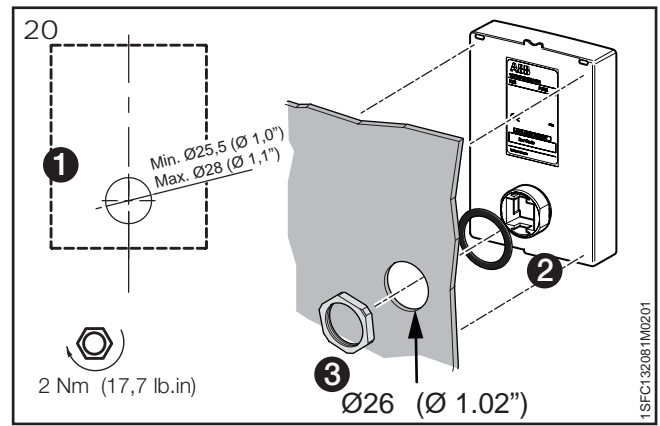
Figure 20: Drill a hole for the detachable keypad.
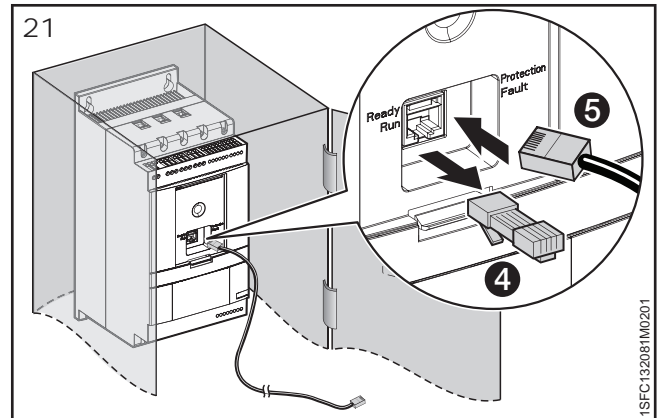
Figure 21: Connect one end of the network cable.
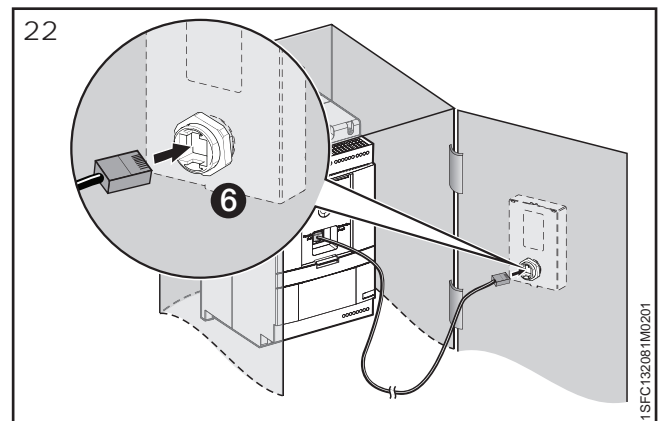
Figure 22: Connect the other end of the network cable.
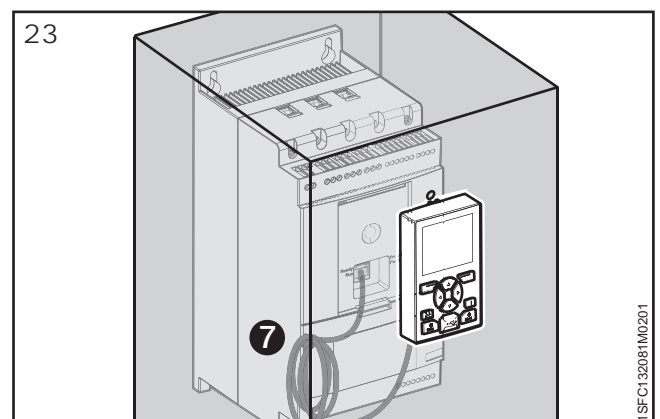
Figure 5: Roll the rest of the hanging cable.

5   Connection

5

This chapter describes the electrical connections as well as connections for communication devices that can be connected to the softstarter.

⚠️ **WARNING**

Mounting and electrical connections of the softstarter shall be made in accordance with local laws and regulations and be performed by authorized personnel.

⚡ **CAUTION**

Hazardous voltage. Can cause death or serious injury. Turn off and lock out all power supplying this device before any work on the softstarter.

⚠️ **WARNING!**

Apply the control supply voltage to make sure that the by-pass relays are in open position before you connect the softstarters PSTX30...PSTX170 to operational voltage for the first time. If not, the equipment can start accidentally. This is necessary to avoid unintentional starting of the equipment during the connection.

ℹ️ **INFORMATION**

ABB personell have to obey the instructions in ABB CISE 15.4.

For basic connection, see **chapter 2 Quick start.**
For wiring diagrams, see **chapter 11 Wiring diagrams.**
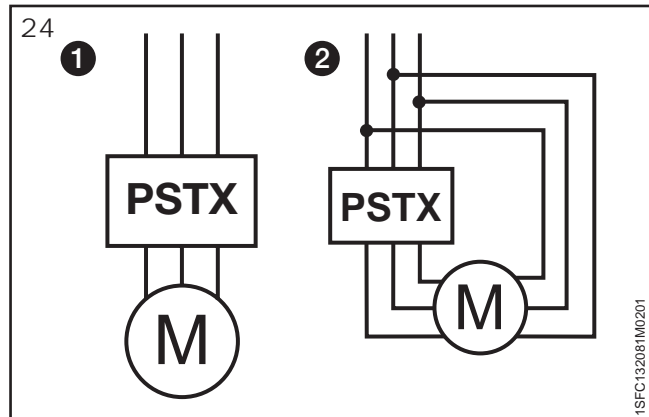
Figure 24: In line (1) and inside delta (2) connection.

5.1   Electrical connection

⚠️ **WARNING**

Capacitors for power factor compensation are not allowed in between the softstarter and the motor, since this can cause current peaks which can burn the thyristors in the softstarter. If such capacitors are to be used, they should be connected on the line side of the softstarter.

5.1.1   Main circuit

ℹ️ **INFORMATION**

The voltage dips may not be more than 5% between softstarter and motor. The cable lenght does not matter.

Softstarters PSTX30...PSTX370 can be connected both In Line, see ❶ **Figure 24,**
and Inside Delta, see ❷ **Figure 24.**
Use wire connection for **PSTX30-105** see **Figure 25** and terminal connection for **PSTX 142-370** see **Figure 3.**

- Connect the line side to terminals 1L1, 3L2, 5L3. see ❶ **Figure 25 and 26.**

- Connect the motor to terminals 2T1, 4T2, 6T3 on the motor side. see ❷ **Figure 25 and 26.**

The terminal marking is printed on the front of the softstarter. For tightening torques and cable thickness, see **chapter 5.1.1.1 Tightening torques and cable dimensions**.
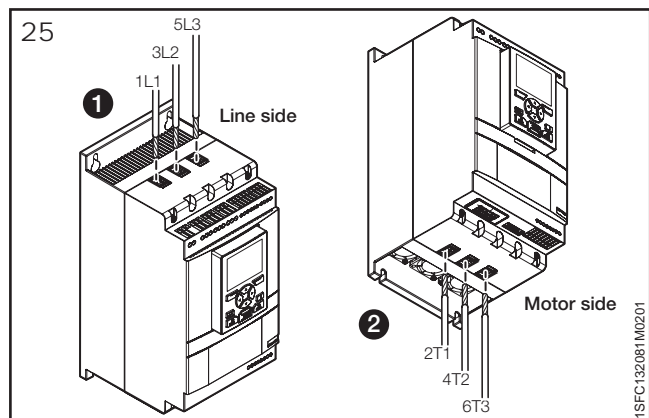
Figure 25: Terminal connection clamps.
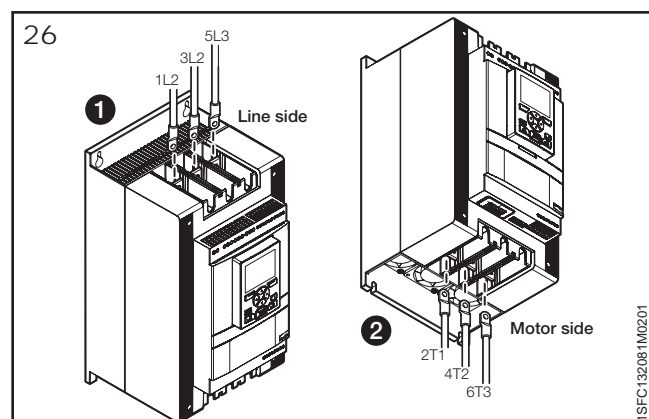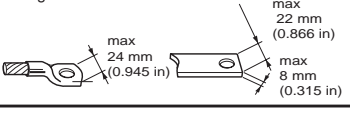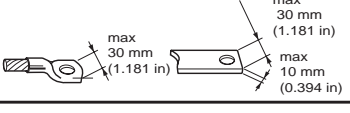
Figure 3: Terminal connection bars

5.1.1.1 Tightening torques and cable dimensions

PSTX18...105

1L1 3L2 5L3 / 2T1 4T2 6T3	M8 — 8 Nm - 71 lb.in	AWG6 .. 2/0 Cu 75°C only Rigid: 10 ... 95 mm² Flexible: 10 ... 70 mm² Rigid/flexible: 2x6 ... 2x35 mm²

PSTX142...170

1L1 3L2 5L3 / 2T1 4T2 6T3	11/6-16 UNF-2A 275 lb.in	Using connection module ATK185: AWG4 to 300kcmil Al Cu 75°C only c(UL)us	M8 — 18 Nm - 160 lb.in	Using connection bars max 24 mm (0.945 in) max 22 mm (0.866 in) max 8 mm (0.315 in)

PSTX210...370

1L1 3L2 5L3 / 2T1 4T2 6T3	3/4-16 UNF-2A 375 lb.in	Using connection module ATK300: AWG4 to 400kcmil ATK300/2: AWG4 to 500kcmil or 2xAWG4 to 2x500kcmil Al Cu 75°C only c(UL)us	M10 — 28 Nm - 240 lb.in	Using connection bars max 30 mm (1.181 in) max 30 mm (1.181 in) max 10 mm (0.394 in)

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5

5.1.2   Control supply and control circuit

Wires in industrial control applications are divided into three groups: main power supply, control supply and control circuit.
Main power supply (1L1, 3L2, 5L3, 2T1, 4T2, 6T3)
Control supply voltage (terminals 1 and 2)
Control circuit (terminals 13 - 21)

5.1.2.1   Control supply voltage - terminals 1 and 2

Connect neutral and phase to terminal 1 and 2.
See Figure 27.

| i | Check that you have the correct supply voltage U_s. See **chapter 3.2.1 General.** |
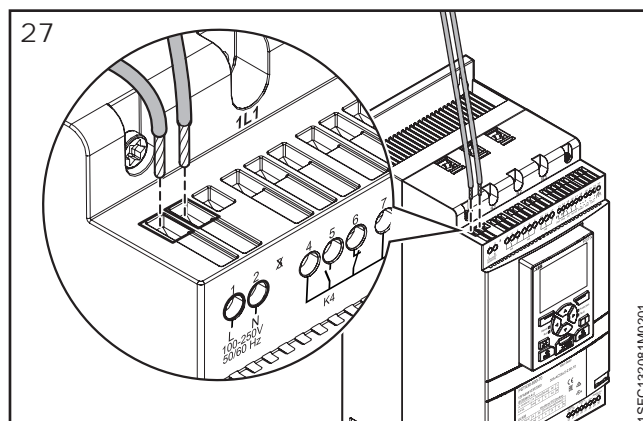
Figure 27: Supply voltage and control circuit.

Tightening torques and cable dimensions.

5.1.2.2   Functional earth - terminal 22

Softstarters type PSTX85...PSTX370 should be earthed using the terminals as shown in **Figure 27** (one connection is sufficient). Connect the cable to an earthing point close to the softstarter. The cable should be as short as possible. A suitable earthing point is next to the softstarter on the mounting plate. Which should also be earthed.

| i | **INFORMATION** |
| | This is not a protective earth, it is a function earth. The earthing cable should be as short as possible. Maximum length 0,5m. |

| i | **INFORMATION** |
| | Do not use functional earth in Marine applications and IT networks. |
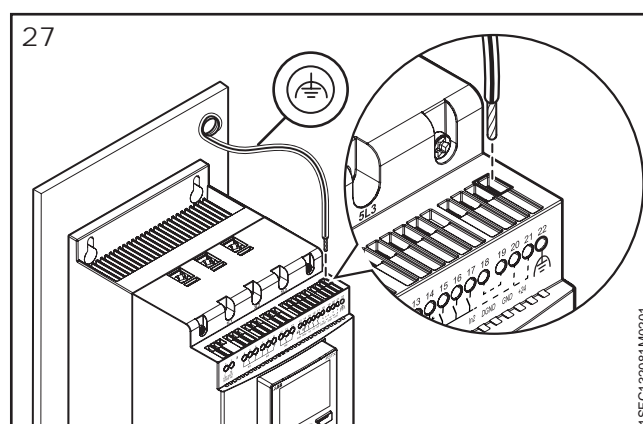
Figure 27: Functional earth, terminal 22.

Tightening torques and cable dimensions.

5.1.2.3 Start and Stop - terminals 13, 14, 18, 19, 20, 21

Internal control voltage

The PSTX Softstarter has a built-in holding circuit and does not require sustained signals on start input. Use internal control supply voltage from terminals 20 or 21.

Connect start and stop terminals using conventional circuit with push buttons. **See Figure 28** and **29.**
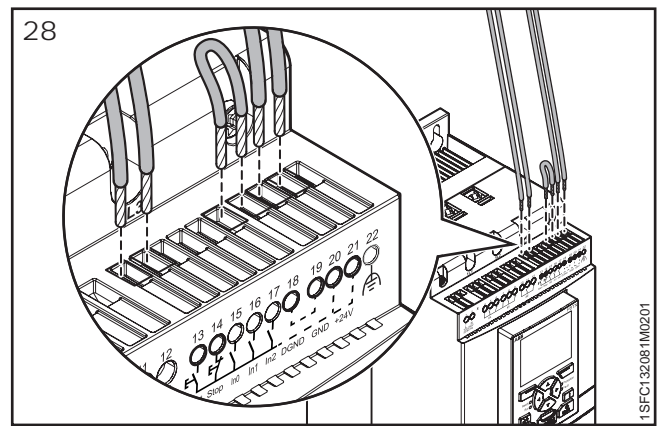
Figure 28: Start and Stop, terminals 13, 14, 18, 19, 20, 21

Tightening torques and cable dimensions.

Figure 29: Holding circuit (pulse for start is enough)

Tightening torques and cable dimensions.

A conventional circuit with auxiliary relay is also possible. **See Figure 30.**
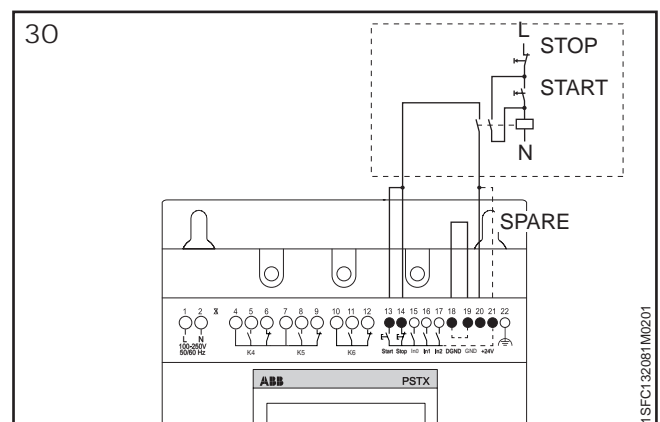
Figure 30: Conventional circuit (maintained start signal requierd)

Tightening torques and cable dimensions.

External control voltage

The softstarter can, if required, also be controlled with an external 24 V DC source from a PLC or similar.

Connect the cables according to **Figure 31** or **Figure 32** depending on which type of control method is used.

⚠️ **WARNING**

Terminal 13, 14 ,15, 16 and 17 should be connected using 24V DC only. Other voltages may damage the softstarter and the warranty may no longer be valid.

Figure 31: Holding circuit with external control voltage (pulse for start is enough)

Figure 32: Conventional circuit with external control voltage (maintained start signal is requierd)

Tightening torques and cable dimensions.

5.1.2.4 Programmable inputs - terminals 15, 16 and 17

⚠️ **WARNING**

Terminal Terminal 13, 14 ,15, 16 and 17 should be connected using 24V DC only. Other voltages may damage the softstarter and the warranty may no longer be valid.

The softstarter has three programmable inputs.

- In0, default reset event.

- In1, default none

- In2, default none

For programming the softstarter inputs, see **chapter 7 Function settings**.

Connect the cables according to **Figure 33, 34** or **35** depending on whether internal or external source is used.

ℹ️ Wiring for sequence start, see next page.
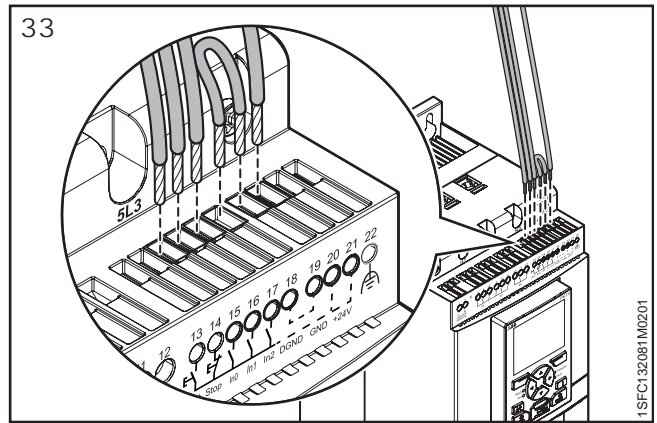
Figure 33: Terminals 16 and 17
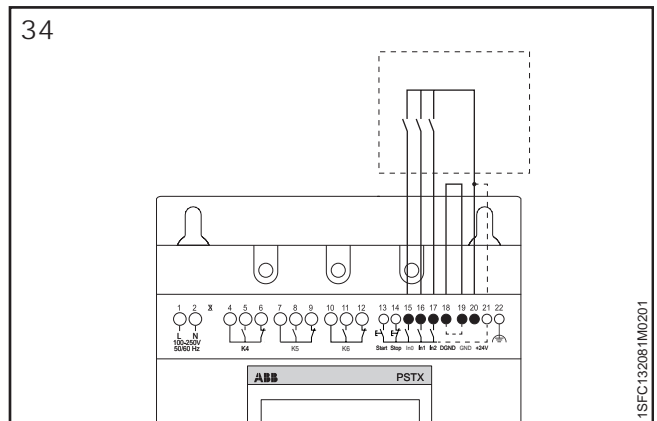
Figure 34: Programmable inputs, terminals 15, 16 and 17

Tightening torques and cable dimensions.

Figure 35: External control voltage

Tightening torques and cable dimensions.

Programmable inputs (Sequence start)

The softstarter can start and stop up to three individual motors used in different applications with different parameter sets. The parameter set is chosen via input signals to the softstarter.

If the softstarter trips for any reason, and the trip is supposed to stop the motor, all motors will be stopped.

When sequence start is going to be used, the wiring should be according to **Figure 36** or **Figure 37.**

The start command (terminal 13, 14, 16 and 17) must be maintained during operation, otherwise a direct stop will be performed.

Soft stop can only be performed for the motor currently fed by the softstarter, and will be achieved by giving a stop command (terminal 4).
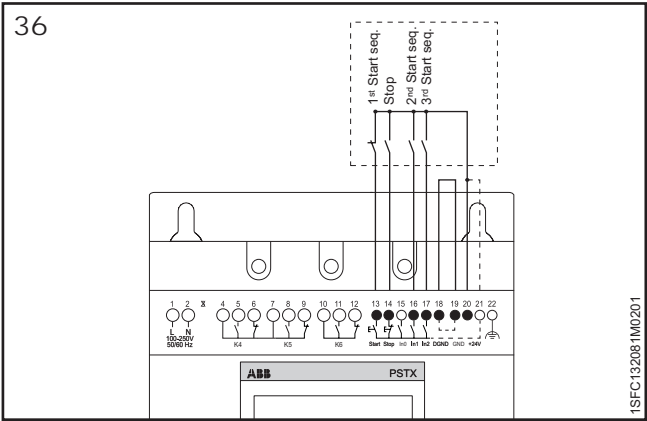
Figure 36: Internal control voltage

Tightening torques and cable dimensions.

Fig. 37: External control voltage

Tightening torques and cable dimensions.

5.1.2.5 Programmable output relay - K4, terminals 4, 5 and 6

The output relay gives a signal depending on the selected function.
Default: Run
See chapter 7 Function settings for programming.
Connect the cables to terminal 4, 5 and 6.
See Figure 38.

Recommended to control line contactor.
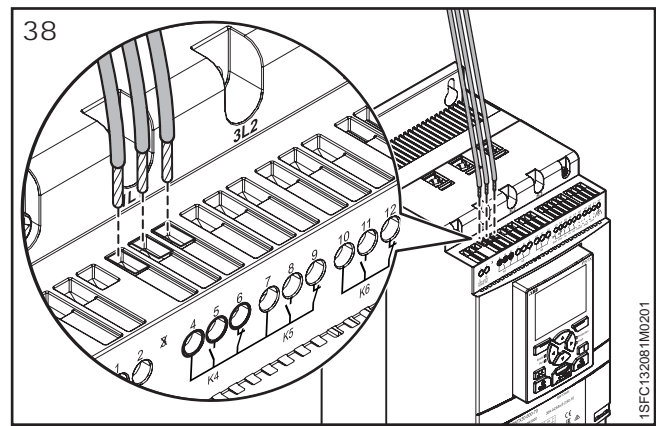
Figure 38: Programmable output relay K4, terminals 4, 5 and 6

Tightening torques and cable dimensions.

5.1.2.6 Programmable output relay - K5, terminals 7, 8 and 9

The output relay gives a signal depending on the selected function.
Default: Top of ramp
See Chapter 7 Function settings for programming.
Connect the cables to terminal 7, 8 and 9.
See Figure 39.
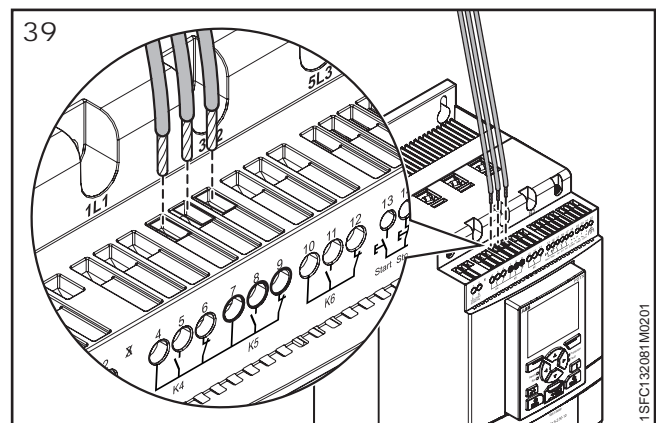
Figure 39: Programmable output relay K5, terminals 7, 8 and 9

Tightening torques and cable dimensions.

5.1.2.7 Programmable output relay - K6, terminals 10, 11 and 12

The output relay gives a signal depending on the selected function.
Default: Event
See chapter 7 Function settings for programming.
Connect the cables to terminal 10, 11 and 12.
See Figure 40.
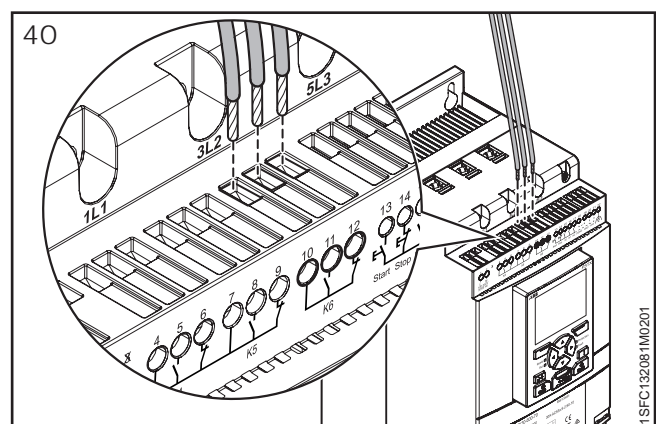
Figure 40: Programmable output relay K6, terminals 10, 11 and 12

Tightening torques and cable dimensions.

PTC/PT100 input

If the motor is equipped with PTC or PT100 elements, the cables shall be connected to terminals 23 and 24. **See chapter 7 Function settings** for programming.

ℹ️ The PTC input uses the same terminals as the Analogue output and only one of these functions can be used at the same time.

3-wire measurement for PT100

To minimize the influence of the wire resistance, a three-wire connection is usually used. By means of the additional wire, two measuring circuits are created. One of these two circuits is used for reference. This way, the tripping device can calculate and take into account the wire resistance automatically. **See Figure 41.**

Figure 41: PT100 - 3 wire

Tightening torques and cable dimensions.

2-wire measurement for PT100

When using 2-wire temperature sensors, the sensor resistance and the wire resistance are added together. The resulting systematic errors must be taken into account when adjusting the tripping device. A jumper must be connected between the terminals T2 and T3. **Table 1 Line length in meter** can be used for PT100 sensors to determine the temperature errors caused by the line length. **See Figure 42.**

Figure 42: PT100 - 2 wire

Tightening torques and cable dimensions.

Error caused by the line

The error resulting from the line resistance amounts to approx. 2.5 Kelvin/Ohm. If the resistance of the line is not known and it is not possible to measure, the error caused by the line can be estimated using the following table.

Temperature errors in °C / K

The table below shows temperature errors, at an ambient temperature of 20° C, depending on the line length and conductor cross section for PT100 sensors.

Table 1   Temperature errors in XX

Line length in m	Wire size mm²			
	0.50	0.75	1	1.5
10	1.8	1.2	0.9	0.6
25	4.5	3.0	2.3	1.5
50	9.0	6.0	4.5	3.0
75	13.6	9.0	6.8	4.5
100	18.1	12.1	9.0	6.0
200	39.3	24.2	18.1	12.1
500	91.6	60.8	45.5	30.2

5.1.2.9   Analogue output

The softstarter has one output for a configurable analog output signal (terminals 29 and 30). The load resistance is maximum 500 ohm for current output, and minimum 500 ohm for voltage output.

The output signal ranges available are 0-10 V, 0 – 20mA or 4-20mA. The default setting is 4-20mA.

The analogue output has its own terminal for the positive output, it is not shared with any other function on the softstarter and it shall refer to the functional ground.

The analogue output can be selected to show:
I (A), U (V), P (kW), P (Hp), Q (kVAr), S (kVA), cos Phi, Motor temp, SCR temp and Energy (kWh).

If the analogue output is used, the cables shall be connected to terminals 29 and 30. **See Figure 43.**

See chapter 7 **Function settings** for programming.

i	The PTC input uses the same terminals as the Analogue output and only one of these functions can be used at the same time.
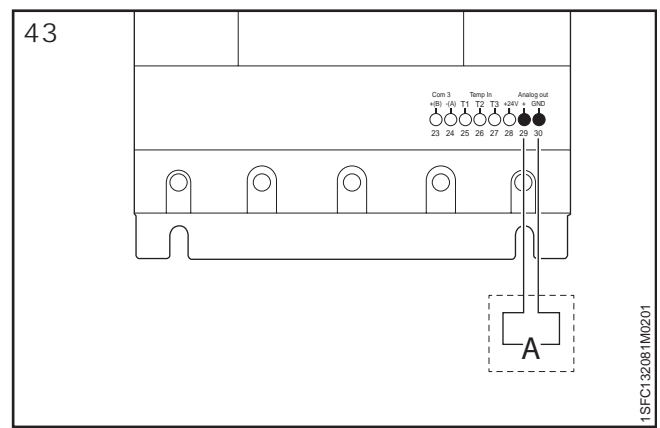
Figure 43: Analogue output

Tightening torques and cable dimensions.

5.1.3   Optional accessories

To connect external devices that support RS485 based communication, the following accessory is used:

• BB Stotz DX1xx-FBP extension module

6   Human machine interface (HMI)

6

This chapter describes how the Human-machine interface (keypad and display) works. For detailed description of each function, see **chapter 7 Functions**.

6.1 Navigation Overview

The Human-machine interface, HMI is used for several purposes such as programming the softstarter, e.g. setup of inputs and outputs, protections, warnings, and communications. The HMI is also used for monitoring, local control and status information of the softstarter. **See Figure 44.**

The HMI contains of:

- Display
- Selection and Navigation keys
- Mini USB port
- LED status indicators

6.1.1 LED indicators

The LED status indicators work as in **Table 1 LED status**:

Figure 44: HMI

Table 1   LED status

LED	Color	Description
Ready ❶	Green	• **Off:** When control supply voltage U_S is off or unconnected. • **Flashing light:** When control supply voltage U_S is On and operational voltage U_e is Off. • **Steady light:** When control supply voltage U_S is On, and operational voltage U_e is On.
Run ❷	Green	• **Off:** When the motor is not running. • **Flashing light:** When softstarter is controlling operational voltage U_e during start or stop ramp. • **Steady light:** When full operational voltage U_e is on at Top of Ramp.
Protection ❸	Yellow	• **Off:** When the softstarter has not tripped on any protection • **Flashing light:** The protection has tripped and reset is possible. • **Steady light:** The protection has tripped and reset is not possible.
Fault ❹	Red	• **Off:** When the softstarter has not tripped on any fault • **Flashing light:** Fault has occurred and reset is possible. • **Steady light:** Fault has occurred and reset is not possible.

See Figure. 45: LED status.

When fault or protection LED is activated, the display will show the actual fault or protection as an event code and an indication text. Press information-key for further information.
See chapter 10 Troubleshooting for description of fault, protections and warnings.
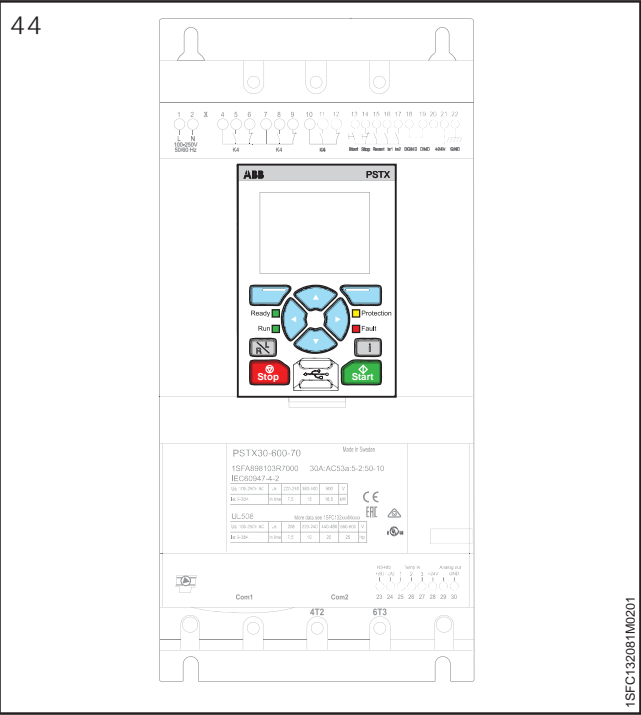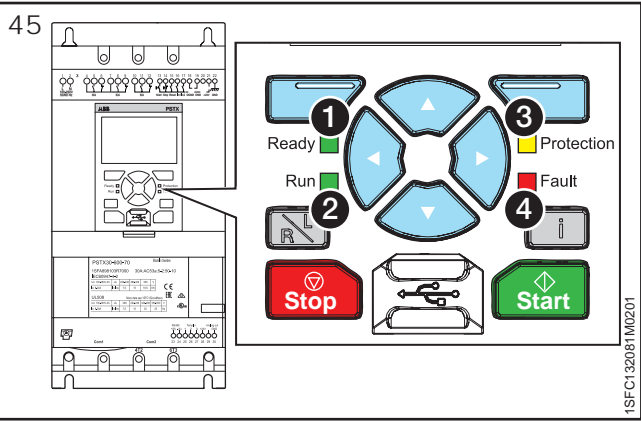
Figure 45: LED status

6.1.2   Keypad

The softstarter has 10 keys on the keypad, **see Figure 46**. This chapter describes the function of each key.

Selection softkeys

The Selection softkeys normally have more than one function, such as selecting, exiting, changing and storing, depending on present dialogue. The display above the key shows the current softkey function. **See ➊ in Figure 46.**

Navigation keys

The Navigation keys are used for navigating in the menu and change the parameter values. A menu/value that are highlighted black in the display can be changed or scrolled. When selecting from a list, the scrolling is done in a closed loop. **See ➋ in Figure 46.**

R\L-key

R\L-key stands for Remote or Local. This key gives you the option to switch the control of the softstarter between local control from the HMI and remote control from hardwire input or fieldbus. **See ➌ in Figure 46.**

i-key

The i-key is an information key for the HMI, and provides context related information about the softstarter status and settings.
Press this key for help and general information about the current setting in the HMI. **See ➍ in Figure 46.**

Stop key

The Stop key is the stop switch for the softstarter. By pressing this key the motor will stop according to set parameters. It is possible to press stop command during the start ramp if required. (Only active in local control mode). **See ➎ in Figure 46.**

Start key

The Start key is the start switch for the softstarter. By pressing this key the motor will start and operate according to the set parameters. (Only active in local control mode). **See ➏ in Figure 46.**
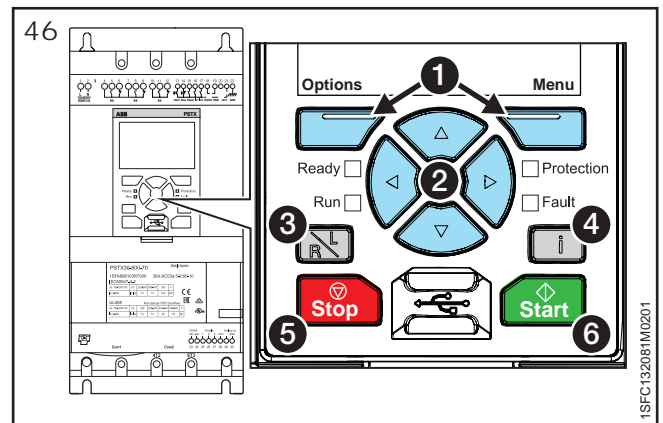
Figure 46: Keypad

Table 2   Keypad, Figure 46

Position	Key
➊	Selection softkeys
➋	Navigation keys
➌	R\L-key
➍	i-key
➎	Stop key
➏	Start key

6

6.1.3   Navigation screen

With the keypad, settings can be set individualy or as a selection of predefined parameters for different applications. The default parameter set is stored in the unit for a possible reset to default values. When the fieldbus communication is selected, parameters can also be modified from this interface.

Press ⊟ "Menu" to go to the menu and then use ⊙ and ⊙ to select parameter and ◁ and ▷ to select menu. The selected parameter is then highlighted black. Press the ⊟ "Select" to make your selection.
See Figure 47.
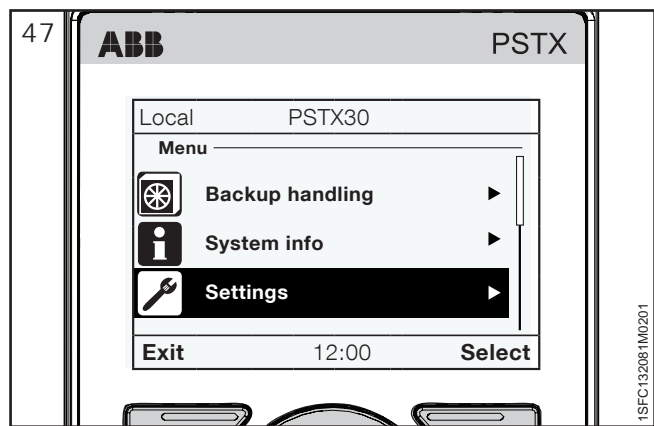
Figure 46: Navigation screen

6.1.3.1 Edit parameter values

The numerical setting
Use the numerical setting when a numerical value is to be set in the softstarter. Use ◁ and ▷ on the Navigation keys to select number, the selected number is highlighted black. Then Press ⊙ or ⊙ to change the value of the selected number. Press ⊟ "Save" to save.
See Figure 48.
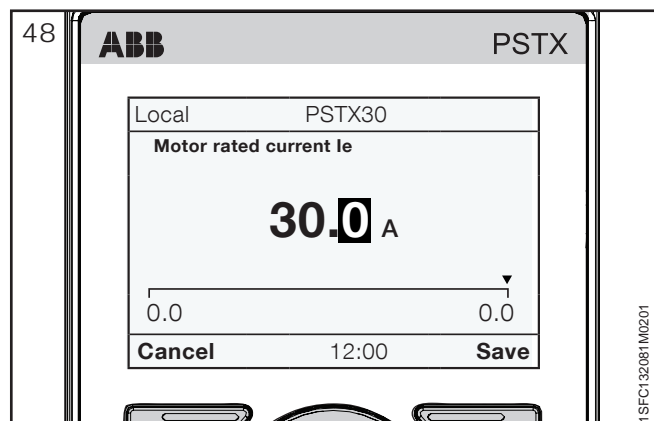
Figure 48: Numeral setting

On/off switch
Select 1 or 0 (on or off) with the on/off switch. Use ⊙ and ⊙ on the Navigation keys. Press ⊟ or ⊟ to change the value of the selected switch. Press ⊟ "Save" to save. **See Figure 49.**
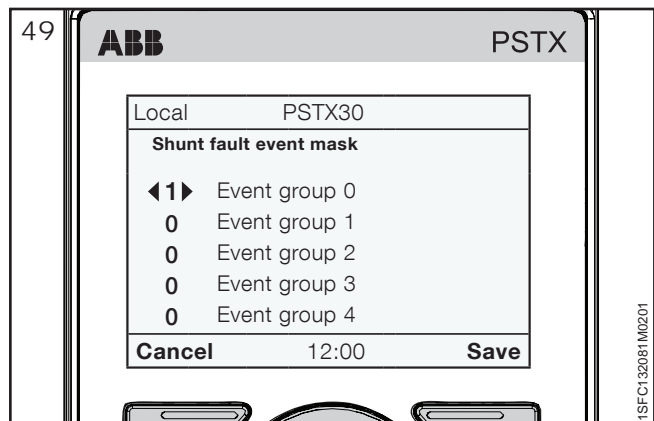
Figure 49: Switch setting

Selection list
Use the Navigation keys to navigate up and down in the lists. The selected option is highlighted black. Press ⊟ "Save" to save.
See Figure 50.
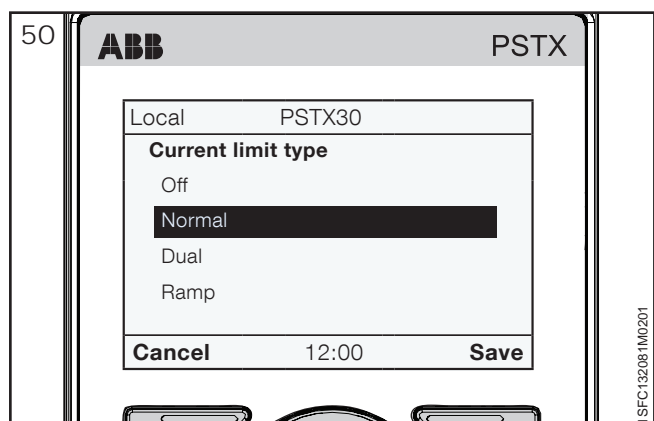
Figure 50: Selection list

6.1.4   How to set a parameter

This chapter shows some examples of parameters that can be set on the PSTX softstarter.

6.1.4.1   Changing the Rated motor current (Setting Ie).

Path in menu:
Menu ▶ Parameters ▶ Complete list ▶ 01 Motor rated current Ie

For more information about Motor Current Ie, see **chapter 7 Functions**.

1.   The Home view is the top level. Press ⬭ "Menu" to enter the menu. The display now appears as in **Figure 51**.

2.   Press ⬭ "Select" to select Parameters menu.

3.   Press ⬭ "Select" to select Complete list.

4.   Press ⬭ "Select" to select 01 Motor rated current Ie.

5.   Press⬭ "Edit" to edit the rated current in Motor rated current Ie.

6.   Use the Navigation keys to set the rated current. Use ⬦ and ⬦ to select number, the current selected number is highlighted black. Then press ⬥ or ⬥ to change the value of the selected number. Save the new setting by selecting ⬭ "Save".
    See Figure 51. If you want to quit, you select ⬭ "Cancel".
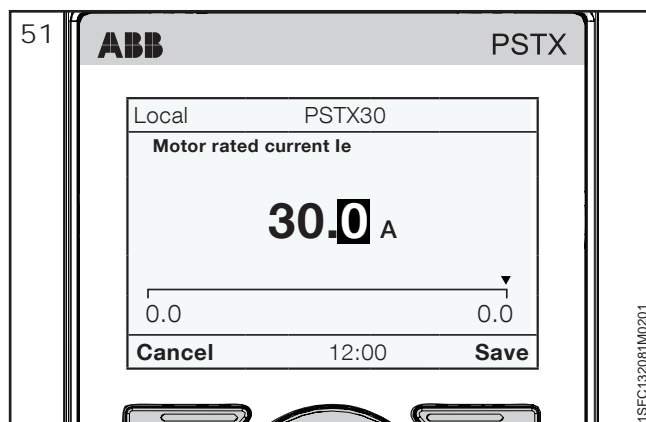
Figure 51: Motor current Ie

6

6.2   Local control from keypad

⚠️ **CAUTION**

When you switch from local control to remote control the setting will apply immediately. If the remote setting has direct motor start it could start the motor automatically and lead to personnel injury.

ℹ️ When you switch from remote control to Local control the softstarter remains in present state when control is changed to local control.

This chapter describes how the Local control interface works. The Local control is used to start and stop the motor from the keypad. When Local control is selected, the softstarter can only be controlled by the keypad.

Local control is listed below:

Table 3   Local control from keypad

Function	Description
Start/stop	Start and stop the motor with the keypad.
R\L	Switch between local and remote control
Motor Jog *	Run the motor as long as Jog is pressed.

* For intormation about Motor jog see **chapter 6.2.4 Motor jog.**

To reach the Motor Jog, follow this path in menu:

Menu ▶ Motor jog

6.2.1   Start key

The start key is the start switch for the softstarter. By pressing this key the motor will start and operate according to the set parameters. **See ❶ in Figure 52.**

6.2.2   Stop key

The stop key is the stop switch for the softstarter. By pressing this key the motor will stop according to set parameters. It is possible to press stop command during the start ramp if required. **See ❷ in Figure 52.**

6.2.3   R\L-key

R\L-key stands for Remote or Local control.
This key gives you the option to control the softstarter remote from digital input, fieldbus or local from the HMI. **See ❸ in Figure 52.**
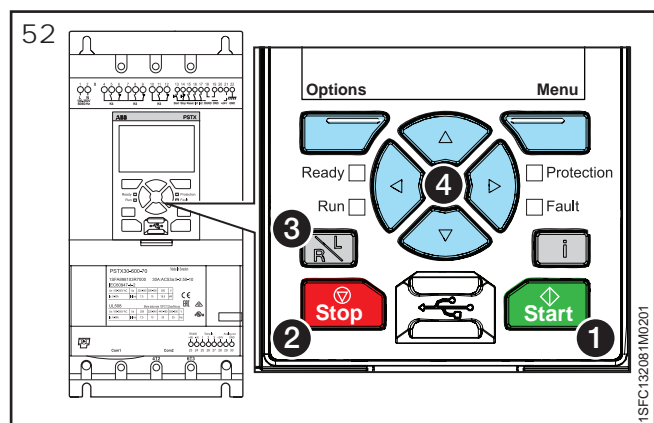
Figure 52: Local control

6.2.4   Motor jog

Path in menu:
Menu ▶ Motor jog

For navigation see Figure 54.
For Motor jog parameter settings,
see chapter 7.9 Slow speed.

Figure 54: Motor jog navigation.

Jog is an slow speed drive function to drive the motor with low voltage output. This feature can be useful to position for example a conveyor belt.

The jog has three predefined speeds:

- Fast Jog

- Jog

- Creep

The speeds can be adjusted with separate parameters. For example: Fast jog backward and jog forward. This function can be operated via the HMI, I/O or Fieldbus.

Press ⊏⊐ "Menu" to enter the Motor jog menu and then select Motor Jog. Use ◀ and ▶ to jog forward and backwards. **See ❹ in Figure 53.** The motor will start and accelerate to the rated speed according to the set parameters as long as the Jog command is activated. The motor stops immediately as soon as the command is released.

It is possible to run the motor both in the forward and reverse direction with at least two different slow speeds.

Figure 53: Motor jog

6.3   Options screen

6.3.1   Overview

In Options screen, it is possible to change the apperence of the Home view of the softstarter and access Active faults/ protections and Active warnings.
Option screen includes the following menues:

• Edit home view

• Active faults/ protections

• Active warnings

Press ⬜ "Options" to enter the Options screen.

6.3.2   Edit home view
Path in menu:
Options ▶ Edit home view

For navigation, **see Figure 54.**
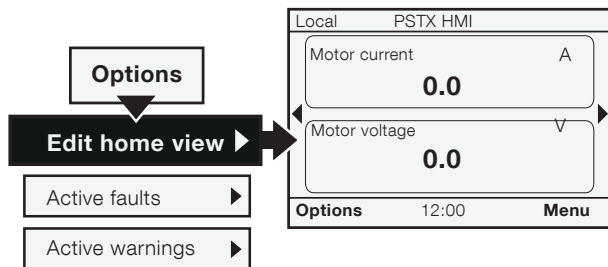
Figure 54: Edit home view navigation.

Use Edit home view to change the appearance of the home view of the softstarter.

6.3.2.1   Add information screens to home view

1.   Press ⬜ "Options" to select Edit home view.

2.   Use the Navigation keys to determine were you want to add an information screen.

3.   Press ⬜ "Add" to add the new information screen to the home view.

6.3.2.2   Edit information screens in home view

1.   Press ⬜ "Options" and then select Edit home view.

2.   Use the Navigation keys to select the display slot you want to edit.

3.   Press ⬜ "Edit" and enter the Display slot menu. Refer to options in **chapter 6.3.2.3 Display slot** to set the new screen in the Display slot menu.

6.3.2.3   Display slot
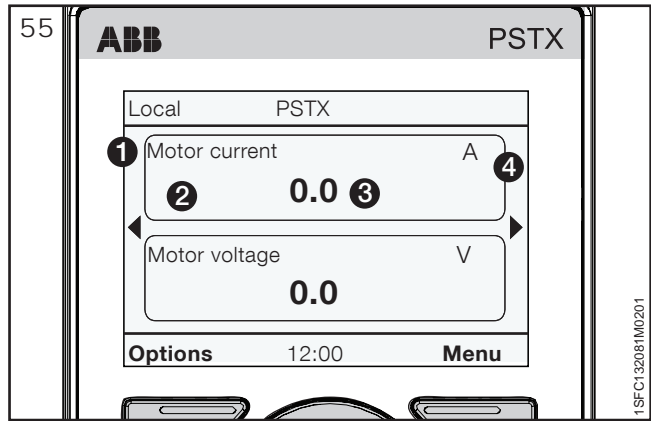
Figure 55: Display slot

In the Display slot menu, the new screen can be set according to the following options:

Signal
Press ⬜ "Edit" to see the list of signals which can be shown in the home view. Use the Navigation keys and then press ⬜ "Select" to select the signal. Selected signal is shown by ❶ in **Figure 55.**

Display style
Choose the display style for the home view. Selected display style is shown by ❷ in **Figure 55.**
Choose between numeric, gauge or graph data:

• Numeric

• Gauge/bar

• Graph 15 minutes

• Graph 30 minutes

• Graph 1 hour

• Graph 24 hours

• N/A

Use the Navigation keys to select display style, press ⬜ "Select" to set the parameter.

Display decimals
Choose the amount of decimals to be shown in the home view. It is possible to choose between 0 to 9 depending on parameter. Use the Navigation keys to change displayed decimals.
Press ⬜ "Save" to save the value. Decimals are shown by ❸ in **Figure 55.**

Display name
It is possible to change the name of the chosen signal. The new name can be up to with 20 characters.
Use the Navigation keys to change the characters.
Press ⬜ "Save" to save the display name. Display name is shown by ❶ in **Figure 55.**

Signal min
Choose the minimum value to be shown in the Home view. Use the Navigation keys to change value.
Press ⬜ "Save" to save the value. Value is shown by ❸ in **Figure 55.**

Signal max
Choose the maximum value to be shown in the Home view. Use the Navigation keys to change value.
Press ⬜ "Save" to save the value. Value is shown by ❸ in **Figure 55.**

6.3.2.4 Scale value range

Use Navigation keys to mark Scale value range and press ⬒ "Select" to enable Scale value range. Three more options will then illuminate in the display slotmenu:

- Display signal min as
- Display signal max as
- Display unit

Display signal min as - Press ⬒ "Edit" to choose the scaled minimum value that is to be shown in the Home view. Use the Navigation keys to change value, Press ⬒ "Save" to save the value. **See ❸ in Figure 56.**

Display signal max as - Choose the scaled maximum value that is to be shown in the Home view. Use the Navigation keys to change value, Press ⬒ "Save" to save the value. **See ❸ in Figure 56.**

Display unit - Type in the unit which is to be displayed in the Home view. It is possible to type a unit with up to 10 characters. Use the Navigation keys to change the characters. ⬒ "Save" to save the Home view unit name. **See ❹ in Figure 56.**
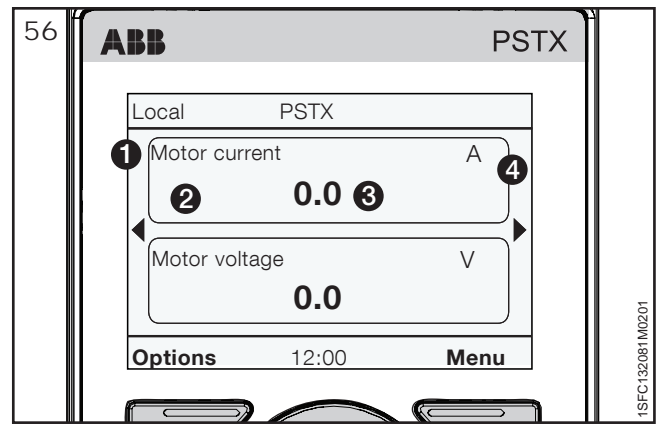
Figure 56: Display slot

6.3.3 Active faults/protections and warnings

Path in menu:
Options ▶ Active faults / protections
Options ▶ Active warnings

Active faults/protections/warnings are also found in the Options menu. The menus contain information about faults and warnings that have occurred during operation, and what protections that are active.
Active faults/protections and warnings menus are highlighted black when a fault protection or warning has occurred.
For navigation **see Figure 57.**

For more information about fault/warnings/protections, see **chapter 10 Troubleshooting.**
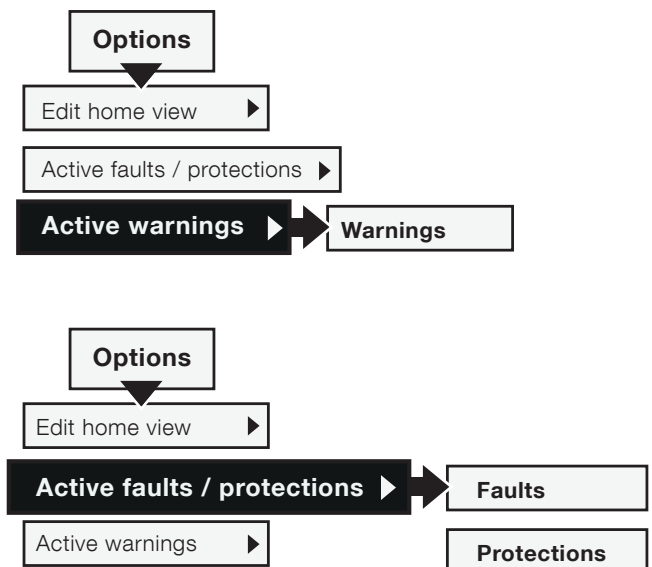
Figure 57: Active fault/warnings/protections navigation

6.4   Menu screen

The menu screen contains seven submenues, described in the following chapters:

Table 4   Menu screen

Chapter	Description
6.4.1 Parameters	Parameter settings for different types of softstarts.
6.4.2 Assistants	Predefined parameters for common applications.
6.2.4 Motor jog	See chapter 6.2.4 Motor jog
6.4.3 Event Log	Show the Event Log, Faults, Protections and Warnings.
6.4.4 Backup handling	Backup parameter settings.
6.4.5 System info	Show product name, type, Firmware version etc.
6.4.6 Settings	Softstarter settings such as Language, Date and Display.

Use Navigation keys to navigate in the submenues. Press ⬜ "Select" to enter a menu. Press ⬜ "Save" to save a new setting. Press ▱ "Cancel" to exit a setting without saving. Press ▱ "Back" to return to previous menu.

6.4.1   Parameters
Path in menu:
Menu ▶ Parameters

The parameter menu contains three submenues, described in the following chapters:

Table 5   Parameters screen

Chapter	Description
6.4.1.1 Complete list	Shows all parameters for advanced setup
6.4.1.2 Favorites	Choose favorite parameter functions for quick selection.
6.4.1.3 Modified	Shows modified parameters.

Use Navigation keys to navigate in the submenues. Press ⬜ "Select" to enter a menu. Press ⬜ "Save" to save a new setting. Press ▱ "Cancel" to exit a setting without saving. Press ▱ "Back" to return to previous menu.

6.4.1.1   Complete list
Path in menu:
Menu ▶ Parameters ▶ Complete list

The Complete list menu should be used if a more advanced parameter setup is required. The complete list menu contains groups of parameters arranged by functions, such as Start and Stop, Communication etc. For navigation, **see Figure 58.**

Use the Navigation keys to navigate the submenues. Press ⬜ "Select" to enter a menu. Press ⬜ "Save" to save a new setting. Press ▱ "Cancel" to exit a setting without saving. Press ▱ "Back" to return to previous state. For function settings and full parameter list,

see Chapter 7 Functions.

Figure 58: Complete list navigation.

Complete list

01 Motor rated current Ie

02 Start and stop

03 Limit

04 Kick start

05 Slow speed

06 Motor heating

07 Motor braking

08 Sequence start

09 Automatic restart

10 Internal IO **11 External IO**

12 Communication

13-19 Protections list 1-7

20-24 Warnings list 1-5

25 Internal faults

26 External faults

27 Presentation

28 Service

---

01 Motor rated current Ie
01.01 Motor rated current Ie

02 Start and stop
02.01 Start mode
02.02 Stop mode
02.03 Start ramp initial level
02.04 Start ramp time
02.05 Stop ramp end level
02.06 Stop ramp time
02.07 Pre-start function
02.08 Pre-start timea

03 Limit
03.01 Current limit type
03.02 Current limit level
03.03 2nd curr lim level
03.04 2nd curr lim time
03.05 Torque limit level

04 Kick start
04.01 Kick start
04.02 Kick start level
04.03 Kick start time

05 Slow speed
05.01 Slow speed forward
05.02 Slow speed fwd strength
05.03 Slow speed reverse
05.04 Slow speed rev strength

06 Motor heating
06.01 Motor heating capacity

07 Motor braking
07.01 Stand still brake strength

08 Sequence start
08.01 Sequence mode
08.02 Ie seq 1
08.03 Start mode seq 1
08.04 Start ramp time seq 1
08.05 Start ramp init lvl seq 1
08.06 Curr lim level seq 1
08.07 Kick start seq 1
08.08 Kick start level seq 1
08.09 Kick start time seq 1
08.10 Torque lim lvl seq 1
08.11 Torque tune seq 1
08.12 Torque ctrl gain seq 1
For full parameter list see chapter 7

09 Automatic restart
09.01 Auto-reset delay time
09.02 Auto-restart
09.03 Auto-restart max attempts

10 Internal
10.03 In2 function
10.04 K4 function
10.05 K5 function
10.06 K6 function
10.07 AO reference
10.08 AO type
10.09 AO max value
10.10 AO min value
10.11 Ext therm sensor - ID
For full parameter list see chapter 7

11 External IO
11.01 1DI0 function
11.02 1DI1 function
11.03 1DI2 function
11.04 1DI3 function
11.05 1DI4 function
11.06 2DI5 function
11.07 2DI6 function
11.08 2DI7 function
11.09 1DO0 function
For full parameter list see chapter 7

12 Communication
12.01 Com3 function
12.02 FB interface connector
12.03 Fieldbus control
12.04 Fieldbus address
12.05 Fieldbus IP address
12.06 Fieldbus IP gateway
12.07 Fieldbus IP netmask
12.08 Fieldbus IP DHCP client
12.09 FB baud rate
12.10 FB parity
12.11 FB stop bits
12.12 Fieldbus DI 1
For full parameter list see chapter 7

Warnings list 20-24
20.01 EOL level
20.02 EOL out
20.03 EOL warning
20.04 Locked rotor level
20.05 Locked rotor init time
20.06 Locked rotor out
20.07 Locked rotor
20.08 Thyristor OL out
20.09 Thyristor OL
For full parameter list see chapter 7

25 Internal faults
25.01 Shunt fault out
25.02 Shunt fault op
25.03 Short circuit out
25.04 Short circuit op
25.05 Open circuit thyr out
25.06 Open circuit thyr op
25.07 Thyristor OL out
25.08 Thyristor OL op
25.09 Heat sink over temp out
25.10 Heat sink over temp op
25.11 Unspecified fault out
25.12 Unspecified fault op

13-19 Protections list
13.01 EOL mode
13.02 EOL class
13.03 EOL dual class
13.04 EOL out
13.05 EOL operation
13.06 Locked rotor level
13.07 Locked rotor trip time
13.08 Locked rotor delay time
13.09 Locked rotor out
13.10 Locked rotor op
13.11 Max no of starts per hour
13.12 Max no of starts per hour out
13.13 Max no of starts per hour op
For full parameter list see chapter 7

26 External faults
26.01 Phase loss out
26.02 Phase loss op
26.03 Bad network out
26.04 Bad network op
26.05 Low supply voltage out
26.06 Low supply voltage op
26.07 High current out
26.08 High current op
26.09 Faulty usage out
26.10 Faulty usage op
26.11 Faulty connection out
26.12 Faulty connection op

27 Presentation
27.01 Language
27.02 Basic set-up at power on

28 Service
28.01 ID
28.02 Line contactor close time
28.03 TOR relay delay time
28.04 Start without start command
28.05 Step down level
28.06 Torque profile start
28.07 Torque finish
28.08 Torque tune
28.09 Torque ctrl gain
28.10 Torque PI intergration time
28.11 Torque slip
28.12 Torque diff
28.13 Torque filter time
For full parameter list see chapter 7

6

6.4.1.2 Favorites

Path in menu:
Menu ▶ Parameters ▶ Favorites

For navigation, **see Figure 60.**

The Favorites menu makes it possible to add favorite parameters for quick selection. Choose between parameters such as Start and stop, Current limit, Kick start, Torque control, etc.

1. Press ⊏⊐ "Select" to enter the Favorites menu and then press ⊏⊐ "Select" to edit the Favorites list.

2. Use the Navigation keys to select a parameter group. Press ⊏⊐ "Open**"** to open the group.

3. Rress ⊏⊐ "Select" to select parameters.
    A checkmark will be shown by the selected parameter, press ⊏⊐ "Unselect" to unselect the parameter. Press ⊏⊐ "Done" to save and exit.
    See Figure 59.

4. The selected Favorites will show directly in Favorites menu for quick selection.
    Press ⊏⊐ "Back" to return to previous menu.
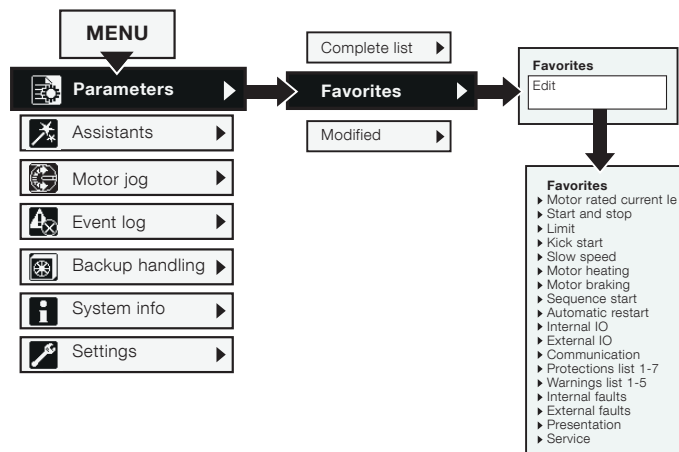
Figure 60: Favorites navigation.

Figure 59: Favorites menu

6.4.1.3 Modified

Path in menu:
Menu ▶ Parameters ▶ Complete list ▶ Modified

For navigation, **see Figure 61.**

The Modified menu contains modified parameters that differs from defaults.
Press ⊏⊐ "Select" and then ⊏⊐ "Edit" to edit the parameter which differs from default. Press ⊏⊐ "Save" to save and return to previous menu. Or press ⊏⊐ "Cancel" to return to previous state without saving.
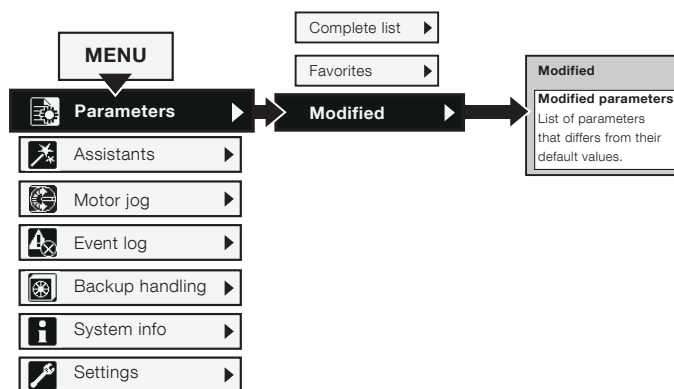
Figure 61: Modified navigation.

6.4.2   Assistants

Path in menu:
Menu ▸ Assistants

For navigation, **see Figure 63.**

For more detailes on how to set Basic set-up and Application set-up, see **chapter 2 Quick start.**

For more information about Assistants and Application list, see **chapter 7.21 Assistants.**

The Assistants menu contains predefined settings and parameters. This should be used if an easy and quick setup is required. Only a few parameters have to be set before a start of the motor is possible. All necessary input data will show up in an automatic loop. The Assistants menu is divided in:

- Basic set-up

- Application set-up

> ℹ️ After selecting an application and performing the desired setting, the application should not be selected again. If this is done, all the settings will be reset to the default settings for the selected application.

Enter the Assistants menu
Find the Assistants menu by pressing ▭ "Menu" and select Assistants with the Navigation keys.
Press ▭ "Select" to enter the Assistants menu.

Basic set-up
Use the Navigation keys to select Basic set-up.
Press ▭ "Select" to enter the Basic set-up.
The Basic set-up menu is divided in 5 steps:
Language, Date and time, Motor data, System configuration and Setup complete.

Application set-up
The Application set-up are quick settings for Applications, Values and Tune settings.
Use the Navigation keys to select Application set-up.
Press ▭ "Select" to enter the Application set-up.
Select what type of application the softstarter is used for by pressing ▭ "Select".
See Figure 62.
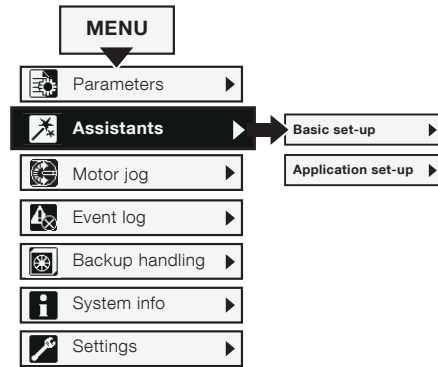
Figure 63: Assistants navigation.
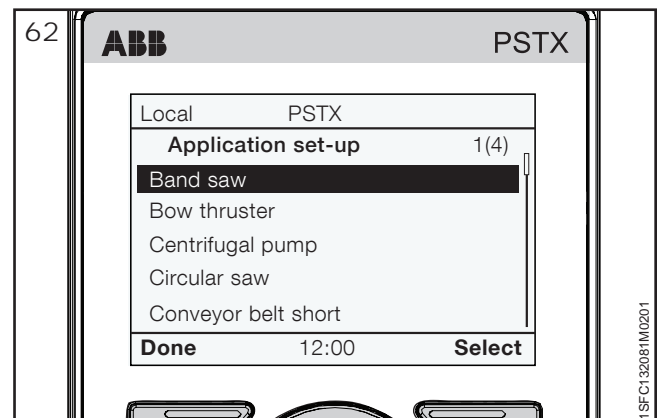
Figure 62: Application set-up.

6.4.3   Event log

Path in menu:
Menu ▸ Event log

For navigation, **see Figure 65.**

The Event log menu checks the event log in the softstarter. When entering this menu the 100 latest events in the log are listed, in chronological order with the latest event as No. 1, the second latest as No. 2 etc.
The events are shown with "type of event" and date.
For details about all events press details.
Use navigation keys to view all entries in the event log.
The types of event logs are:

- Faults

- Protections

- Warnings

- Parameter changed

- Run

See Figure 64.

Faults
Use the Navigation keys to select a Fault and press ⬭ "Details" to read details about the Fault (Name, On time and Event count). Then press the i-key to see information about the Fault. Press ⬭ "Back" to return to Faults log menu.

Protections
Use the Navigation keys to select a Protection and press ⬭ "Details" to read details about the Protection (Name, On time and Event count). Press the i-key to see information about the Protection. Press ⬭ "Back" to return to Protections log menu.

Warnings
Use the Navigation keys to select a Warning and press ⬭ "Details" to read details about the Warning (Name, On time and Event count). Then press the i-key to see further information about the Warning. Press ⬭ "Back" to return to Warning log menu.

Parameter changed
Use the Navigation keys to select a parameter and press ⬭ "Details" to read details about the parameter which has been changed (Name, On time and Event count). Press ⬭ "Back" to return to Warning log menu.

Run
Use the Navigation keys to select a run event and press ⬭ "Details" to read details about the run event (Name, On time and Event count). Press ⬭ "Back" to return to Warning log menu.
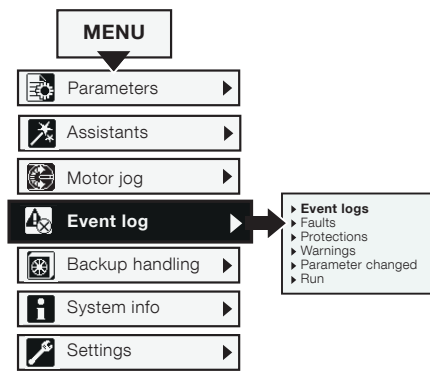
Figure 65: Event log navigation.
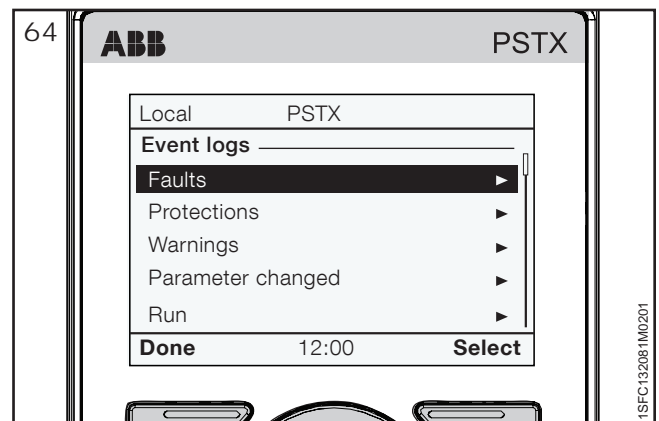
Figure 64: Event log.

6.4.4 Backup handling

Path in menu:
Menu ▶ Backup handling

For navigation, see Figure 66.

The detachable keypad can be used to transfer parameters from one softstarter to another during commissioning.
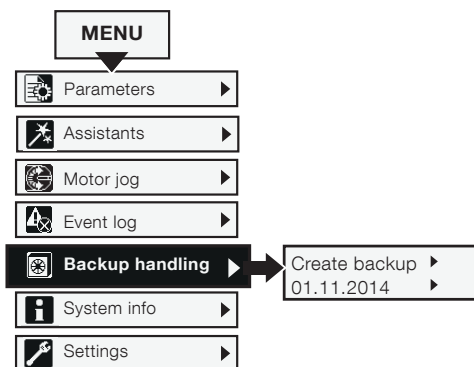
Figure 66: Backups handling.

Transfer of parameters

To transfer (or copy) parameters from one softstarter to another, connect the keypad to the chosen softstarter and follow the instructions in **chapter 6.4.4.1** and **chapter 6.4.4.2** below:

6.4.4.1 Create backup

1. Press 🔲 "Select" to enter the Backups handling menu.

2. Press 🔲 "Create backup" to create a backup.

3. The download of parameters will show as in **Figure 67**. The name of the backup file is displayed as the day, month and year it was created.

Replace backup

The softstarter can store two backups. Use the Navigation keys to select a earlier backup and press 🔲 "Replace", to replace a backup.
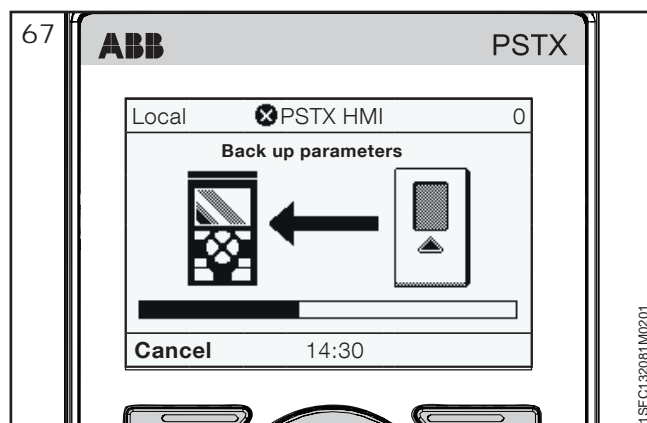
Fig. 67: Downloading parameters.

6.4.4.2 Uploading of parameters

1. After finishing the download of parameters, detach the HMI from the softstarter.

2. Connect the HMI to the softstarter that is to receive the backup from the HMI.

3. Enter the Backup handling menu and use the Navigation keys to select the backup.

4. Press 🔲 "Select" to upload parameters. The upload of parameters will show as in **Figure 68.**
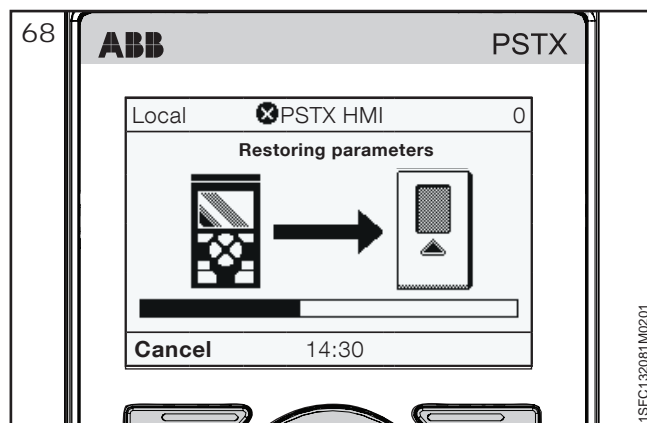
Fig. 68: Uploading parameters.

6.4.5 System info

Path in menu:
Menu ▶ System info

For navigation, **see Figure 69.**

The System info menu contains system info such as Firmware version and Serial number. In the System info menu it is possible to see system info of Softstarter and HMI. Press ⬜ "Select" to enter the System info menu. Use the Navigation keys to make your selection. Press ⬜ "Back" to return to previous menu.

MENU	
Parameters	▶
Assistants	▶
Motor jog	▶
Event log	▶
Backup handling	▶
System info	▶
Settings	▶

Softstarter	
FW version:	1.11.0
Serial number:	00000

Softstarter ▶

HMI ▶

HMI	
FW version:	1.5.0
Serial number:	00000
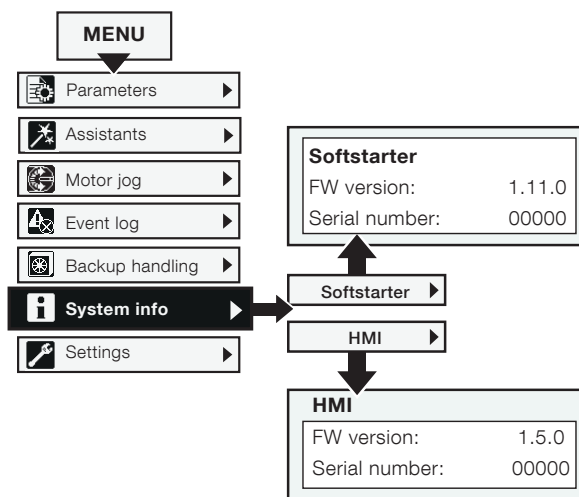
Fig. 69: System info navigation.

6.4.6 Settings

Path in menu:
Menu ▶ Settings

For navigation, **see Figure 70.**

The settings menu contains softstarter set-up parameters. The settings are described in the following chapters:

Table 6 Settings menues

Chapter	Description
6.4.6.1 Language	Change language of the HMI
6.4.6.2 Date & time	Set date and time for the softstarter
6.4.6.3 Display settings	Change Contrast, brightness etc.
6.4.6.4 Reset to defaults	Home view layout
	Will be available in a future release:
	- Reset fault log
	- Reset all parameters

Settings can be set with Keypad and Fieldbus communication.
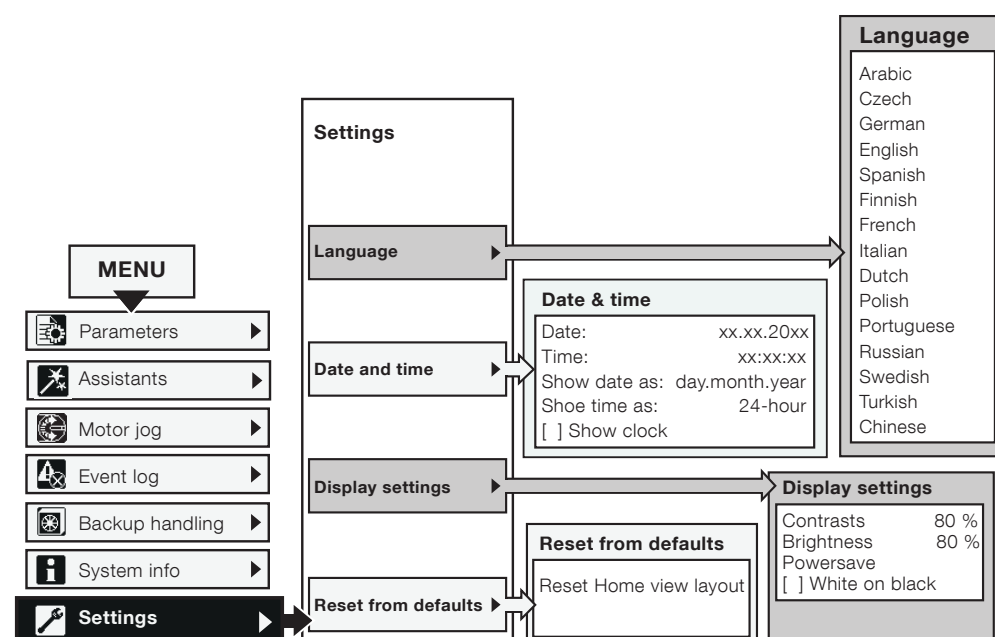
Figure 70: Settings navigation.

6.4.6.1 Language

Path in menu:

Menu ▶ Settings ▶ Language

For navigation, **see Figure 71.**

The interface can be set to any of the following languages:

Table 7   Language

Language	Abbreviation on the display
Arabic	AR
Czech	CS
German	DE
English	US/UK
Spanish	ES
Finnish	FI
French	FR
Italian	IT
Dutch	NL
Polish	PL
Portuguese	PT
Russian	RU
Swedish	SV
Turkish	TR
Chinese (simplified chinese)	ZH
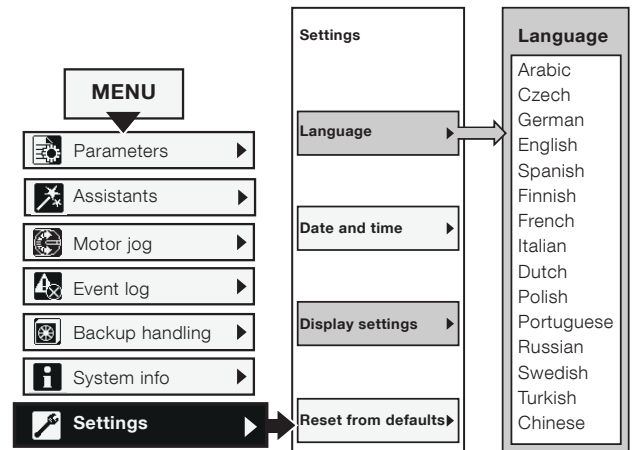
Figure 71: Language navigation.

Follow the instructions below to access the language settings menu (start from Home view):

1.   Press ⬭ "Select" once to enter the menu.

2.   Use Navigation keys to navigate to the Settings menu. (The icon symbols a wrench).

3.   Press the ⬭ "Select" to enter the Settings menu.

4.   Highlight the first alternative and press ⬭ "Select" and then "Edit" to enter Language settings.

5.   Use ⬥ and ⬦ to select language. **See Figure 72**.

6.   Press ⬭ "Save" to save the selected language.

Figure 72: Language menu.

6

6.4.6.2 Date and time

Path in menu:
Menu ▶ Settings ▶ Date and time

For navigation **see Figure 73.**

Date and Time settings includes all date and time configurations for the softstarter.
To change the settings in the Date & Time menu, press ⬒ "Edit" to enter the setting. Press "Save" to save the set value. **See Figure 74.**

Table 8 Date & Time settings

Option	Function
Date	Set date: Day, month and year.
Time	Set time: Hour, minutes and seconds.
Show date as	The date can be displayed in three different ways, depending on the selected type. The following will be displayed at top level: CE day . month . year US month/day/Year SO year–month–day
Show time as	Set the time to be displayed in 12-hour or 24-hour
Show clock	Show clock On / Off

Real time clock

The Real time clock is the local time in the softstarter. The clock stays running 2 hours after control supply power has been turned off. Set date and time again if a longer power outage would occur.

When the configuration of the time setting is completed, it is possible to return to the Home view, top level, by pressing ⬒ " Back" 3 times.
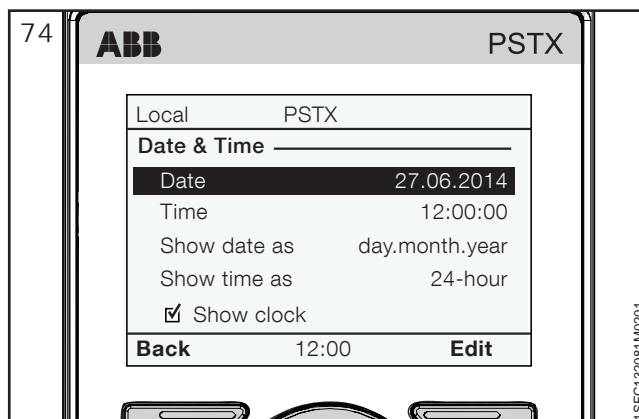
6.4.6.3 Display settings

Path in menu:
Menu ▶ Settings ▶ Display settings

For navigation, **see Figure 75.**

The Display settings includes all display configurations of the softstarter. To change the Display settings, Press ⬒ "Edit" to enter the setting level. Press ⬒ "Save" to save the set value.

Table 9 Display settings

Option	Function
Contrast	Set the contrast intensity 0 ... 100%
Brightness	Set the brightness intensity 0 ... 100%
Power save	This option turns off the display backlight after selected time. You can set the Power save to start within 30 minutes, 1, 2, or 5 hours or Never
White on black	White on black display On / Off

Figure 73: Date & time.

Figure 74: Language menu.
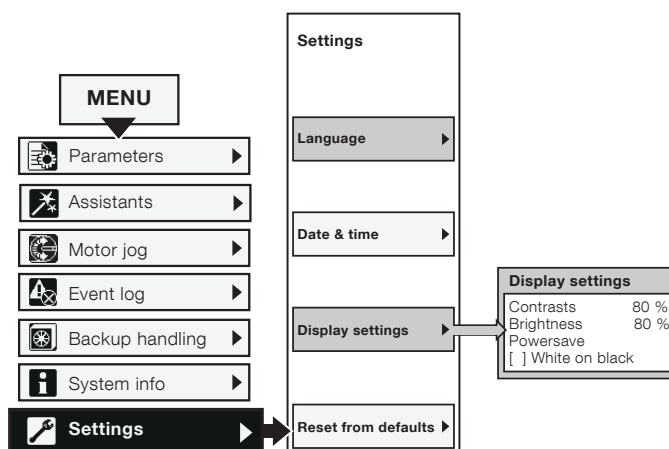
Figure 75: Display settings.

6.4.6.4 Reset to defaults

Path in menu:

Menu ▸ Settings ▸ Reset to defaults

For navigation, **see Figure 76.**

The Reset to defaults menu is used to reset home view layout, parameters or operating data back to factory default settings.

The control supply voltage should be disconnected and reconnected. The real time clock, the hour run meter, the number of starts and the presentation language will not be affected by the reset

1. Press ⬒ "Select" to enter the Reset to defaults menu.

2. Use the Navigation keys to select between;
    Home view layout
    Parameters
    Operating data

3. Press ⬒ "Select" to select the data which is to be reset.

4. Press ⬒ "Yes" to reset, or press ⬓ "No" to cancel.

Confirmation of reset will be displayed as "Done" on the display.

Reset operating data

Reset operating data is divided in:

*   Active energy

*   Rective energy

*   Number of starts

*   Motor run time

*   Thyristor run time

Use the Navigation keys to select which data to reset. Press ⬒ "Reset" to reset, or press ⬓ "Back" to return to Reset to defaults menu.

Confirmation of reset will be displayed as "Done" on the display.
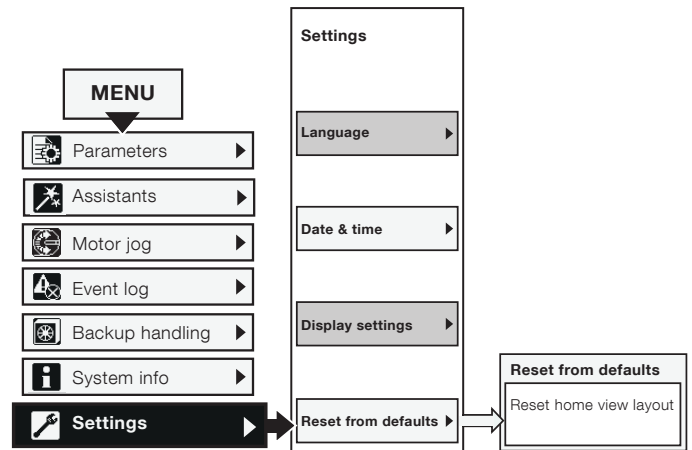
Figure 76: Reset to defaults.

7   Functions

Introduction

This chapter contains detailed descriptions of all the softstarter functions and the parameters for configuring them.

Functions

The functions in this chapter is presented in the following order:

7.1   Functions

Chapter	Function
7.1	**Voltage ramp**
7.1.1	Voltage ramp start
7.1.2	Voltage ramp stop
7.2	**Torque ramp**
7.2.1	Torque ramp start
7.2.2	Torque ramp stop
7.3	**Full voltage start**
7.4	**Direct stop**
7.5	**Stand still brake**
7.6	**Current limit**
7.7	**Kick start**
7.8	**Slow speed**
7.9	**Motor heating**
7.10	**Sequence start**
7.11	**Automatic restart**
7.12	**Inputs/outpus**
7.12.1	Digital Inputs
7.12.2	Relay outputs
7.12.3	Analog outputs
7.12.4	Temperature sensor
7.13	**Fieldbus**
7.14	**Eventgroups**
7.14.1	Protections
7.14.2	Warnings
7.14.3	Faults
7.15	**Special features**

Setting parameters

Set the parameters via HMI

With the HMI Keypad, parameters can be set as individual parameter settings, or as a selection of predefined parameters for different applications.

The HMI complete list consist of parameter groups that are displayed:

7.2   Parameter groups

01 Motor rated current Ie
02 Start and stop
03 Limit
04 Kick start
05 Slow speed
06 Motor heating
07 Motor braking
08 Sequence start
09 Automatic restart
10 Internal IO
11 External IO
12 Communication
13 ... 19 Protections groups 0-7
20 ... 24 Warnings groups 0-4
25 Internal faults
26 External faults
27 Presentation
28 Service

For navigation sheets, **see chapter 6.4. Parameters.**

Set the parameters via Fieldbus/PLC

When Fieldbus is used, parameters can be modified from the PLC.

More details about parameter settings modified via Fieldbus/ PLC are provided in a separate document specification. **TBD (to be determined)**

9

Softstarter states

The softstarter has several operational states, in which different functions are available.

Functions can be operational in one or more softstarter states. If a function is not operational in all states, this is noted in the respective function description.

The softstarter has the following states:

- Individual function
- Pre-start
- Stand by
- Start ramp
- Stop ramp
- TOR (Top of ramp)

Pre-start

In Pre-start state the softstarter runs functions that are intended to run before the softstarter goes into Start ramp state. A pre start function runs during a configurable pre set time. Then the softstarter continues to Start ramp state:

Pre-start functions are:

- Motor heating
- Stand still brake
- Slow speed forward
- Slow speed reverse

The pre-start functions can also be run as individual functions.

Start ramp

In Start ramp state the softstarter runs different settable start functions to soft start a motor by controlling the output voltage or torque. The Start ramp ends and goes into Top of ramp state when the output voltage reaches 100 % voltage.

Settable start functions are:

- Voltage start ramp
- Tourqe start ramp
- Full voltage start ramp

Stop ramp

In Stop ramp state the softstarter runs stop functions to soft stop a motor by controlling the output voltage or torque. The stop ramp state ends and goes into stand by state when the output voltage reaches the pre-set Stop ramp end level.

Settable stop functions are:

- Voltage stop ramp
- Tourqe stop ramp
- No ramp

Top of ramp

When the motor reaches Top of ramp, (100 % nominal speed) the softstarter closes the by-pass and do not control the motor. In Top of ramp state the softstarter only runs diagnostics.

Stand by

In Stand by state the softstarter runs no functions except diagnostics.

Individual function

In Individual function state, the softstarter runs individual functions.

Individual functions are:

- Motor heating
- Stand still brake
- Slow speed forward
- Slow speed reverse

7

Motor Current Ie

Set the motor current before the softstarter is used for the first time.

The setting of this parameter shall be configured to the rated nominell current of the motor.

⚠️ **WARNING**

All PSTX softstarters must be configured to the rated current of the motor.

Motor Current Ie is configured with the following parameters:

Parameter	Description	Setting range	Default value
01.01 **Motor Current Ie**	Set the nominal current of the motor. For good performance it is important that it is set to the correct value. For Inside Delta connection, this parameter shall be set to 58% of the nominal motor current.	9.0 A...1250A	*9.0 A

* Depends on softstarter model.

7.1 Voltage ramp

When using the Voltage ramp, the voltage increases linearly from Initial start level to full voltage during start, and decreases linearly from the Step down level to Stop end voltage level during stop, **see Figure 77**.

Since the torque depends on both the voltage and the current, the torque will not always follow the voltage curve. This has the effect that the the torque will not increase or decrease linearly.
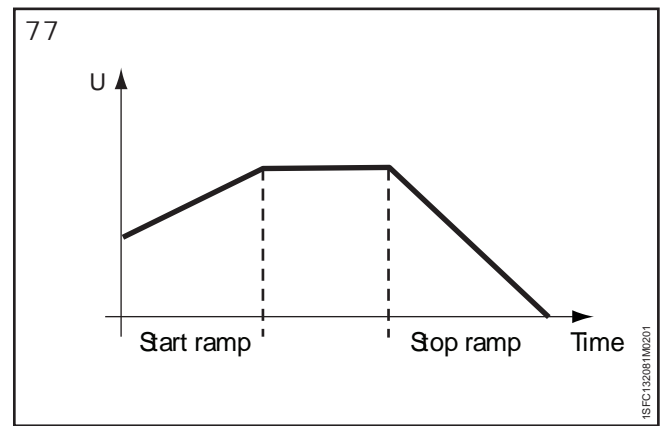
Figure 77: Start and stop ramp

7.1.1 Voltage start ramp

When the softstarter is given a start signal, the softstarter quickly increases the voltage to the Initial voltage level to set Start ramp initial level. The softstarter then controls the output voltage in a start ramp.

When the output voltage reaches Top of ramp, the softstarter closes the by-pass, **see Figure 78**.

To reach Top of ramp the following conditions are needed:

- Pre-set Start ramp time have passed, i.e. 100% output voltage.
- The current is below 1.2 x nominal motor current.

The Start ramp time is the time it takes to go from Initial voltage level to full voltage. The actual time to reach the Top of ramp state also depends on the current, which means that the time to reach Top of ramp can be longer than the set Voltage ramp time.

If the motor is to start with a very heavy load, the start ramp time can be longer than usual.

Exampel: If the Start ramp time is set to 2 seconds and the motor is supposed to start a heavy load. This can cause the output current to not go below set 120% of nominal motor current when the pre-set start ramp time is reached.
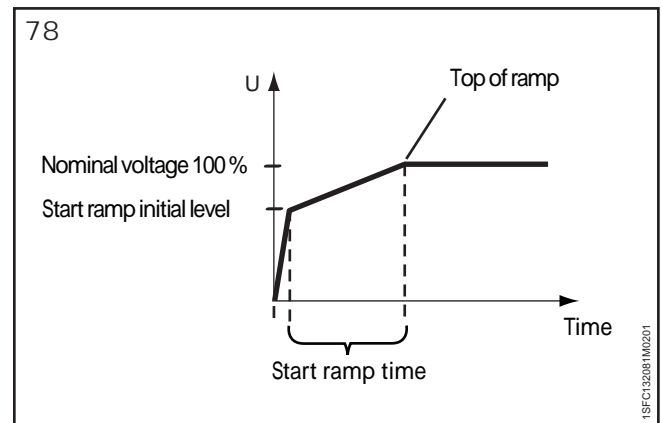
Figure 78: Voltage start ramp

Voltage start ramp is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.01 **Start mode**	Set the Start mode to Voltage ramp.	Voltage ramp, Torque ramp, Full voltage ramp	Voltage ramp
02.03 **Start ramp Initial level**	Set the voltage level from where the start ramp initiates	10 ... 99%	30%
02.04 **Start ramp time**	Set the effective time it takes for the voltage to reach 100%.	1 ... 120s	10s

7.1.2   Voltage stop ramp

When the softstarter is given a stop signal, the softstarter decreases the output voltage to the motor in a quick stop ramp, from full voltage down to set Step down voltage level. For best performance the step down level shall be set to 80%.

When step down level is reached the softstarter controls the output voltage during pre set Stop ramp time to End voltage level and cuts the output voltage to the motor, **see Figure 79**.
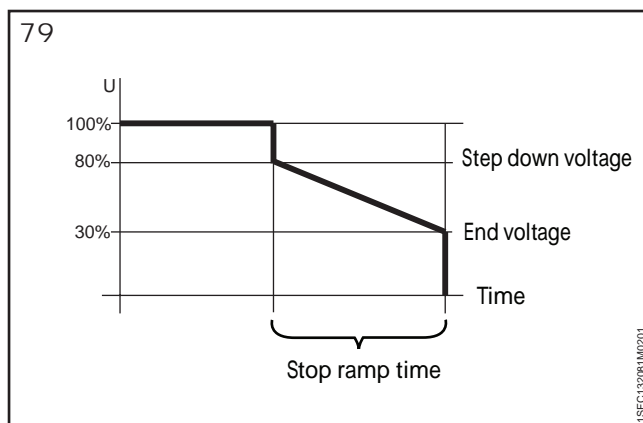
Figure 79: Voltage stop ramp

Voltage stop ramp is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.02 **Stop mode**	Set to voltage ramp.	No ramp, Voltage ramp, Torque ramp, DC Brake, Soft brake	No ramp
02.05 **Stop ramp end level**	Sets the level from where the stop ramp ends and the power to the motor is cut (voltage level for Voltage stop and torque level for Torque stop).	10 ... 99%	30%
02.06 **Stop ramp time**	Sets the effective time it takes for the voltage to reach end level.	0 ... 120 s	10 s
28.05 **Step down level**	Sets the level from where the stop ramp initiates.	10 ... 100 %	80%

7.2   Torque ramp

When using the Torque ramp, the output voltage is controlled, so that the output torque will follow a predefined optimal torque curve during start and stop ramp.

For Torque start ramp there is four different adjustable torque curves. See description of torque profile parameters for examples on when to use which curve.

The curves are:

- Constant
- Linear
- High inertia
- Progressive

When using the Torque start ramp start, the rotational speed is constant if the set torque curve corresponds to the actual load curve. The output voltage will not increase linearly, as when using the voltage start ramp, **see Figure 80**.

The Torque ramp benefits the mechanical starting behaviour of the equipment driven by the motor, to be softer than when using the Voltage start ramp.

For Torque stop ramp there is one fixed torque curve. This fixed torque curve is optmimized for pump applications.
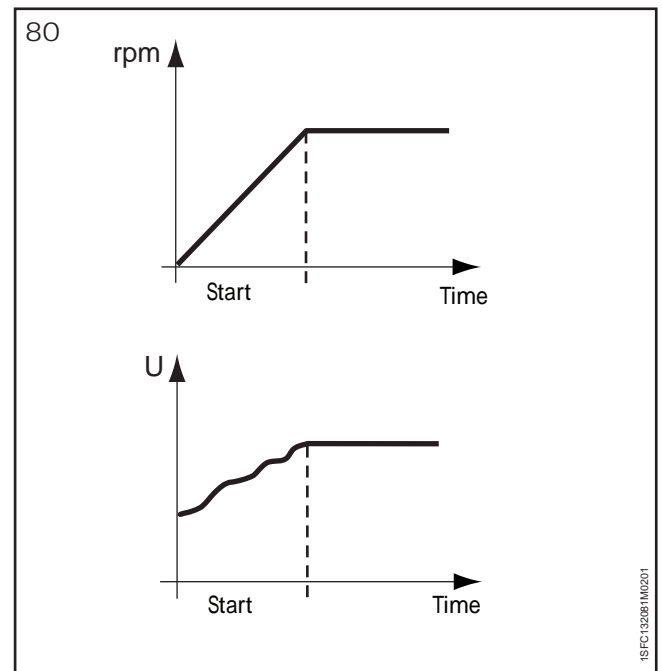
Figure 80: Torque start ramp

7

7.2.1 Torque start ramp

When the softstarter is given a start signal, the softstarter makes a quick ramp to set Start ramp initital level. Then the softstarter controls the output voltage so that the output torque will follow a predefined optimal torque curve during pre-set time to 100 % nominal torque.

When the output voltage reaches 100 % nominal voltage (Top of ramp), the softstarter closes the by-pass.

To reach Top of ramp the following conditions need to be met:

- The output voltage reaches 100 % nominal voltage.

- The current is below 1.2 x nominal motor current.

The time between the start signal and when nominal torque is reached is the start ramp time.

The start ramp time can be longer depending on if the motor is to start with a very heavy load.

Exampel: If the Start ramp time is set to 2 seconds and the motor is supposed to start with a heavy load. This can cause that the output current does not go below set 120% of nominal motor current when the pre-set start rampt time is reached.

Torque start ramp is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.01 **Start mode**	Set to Torque ramp.	Voltage ramp, Torque ramp, Full voltage start	Voltage ramp
02.03 **Start ramp Initial level**	Sets the torque level from where the start ramp initiates.	10 ... 99%	30%
02.04 **Start ramp time**	Sets the time it takes for the voltage to reach 100%.	1 ... 120s	10s
03.05 **Torque limit level**	Sets the limit for the torque during soft start with torque control.	20...200%	150%
28.06 **Torque profile start**	Sets the shape of the torque ramp during start. • Constant setpoint is for centrifuge • Linear is for compressor • High inertia pump is for long conveyor belts • Progressive curve is for centrifugal pump	Constant setpoint, Linear ramp, Progressive curve, High inertia curve	Linear ramp
28.07 **Torque finish**	Sets the operational torque for Torque start ramp setting in percentage of base torque.	30...500%	100%
28.08 **Torque tune**	Sets the adjustment of resistive losses.	0...1000%	100%
28.09 **Torque ctrl gain**	Sets the speed of the voltage regulator during torque start and stop. It seldom needs to be changed, but if a dip occur in the torque curve during stop, increasing this value might solve it.	0.01 ... 10	0.04
28.10 **Torque PI intergration time**	Sets the integration time of PI controller.	0.001 ... 10 s	0.002 s
28.11 **Torque slip**	Sets the slip difference from nominal to pull-out torque in percentage.	0.1 ... 100 %	1.0 %
28.12 **Torque diff**	Sets the maximum desired difference between reference and actual torque in percentage.	0.1 ... 100 %	2.0 %
28.13 **Torque filter time**	Sets the Torque control filter time in seconds.	0.01 ... 10 s	0.02 s

7.2.2   Torque stop ramp

When using the Torque stop ramp, the output voltage to the motor is controlled so that the torque will follow a predefined optimal curve from the Step down level to end voltage during stop. This has the benefit that the mechanical stopping behaviour of the equipment driven by the motor, will be much softer than when using voltage ramp. **See Figure 81.**

This can be especially useful in pump applications where a sudden stop can cause water hammering and pressure surges.
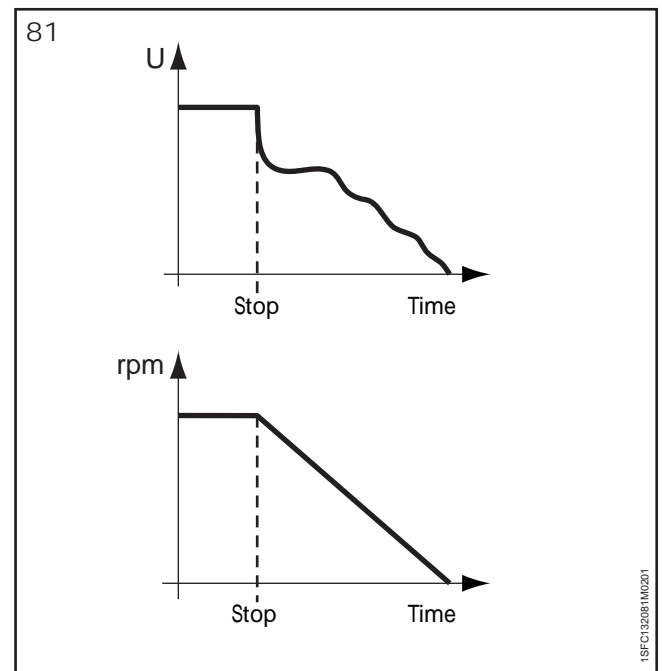
Figure 81: Torque stop ramp

Torque stop ramp is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.02 **Stop mode**	Set to Torque ramp.	No ramp, Voltage stop ramp, Torque stop ramp	No ramp
02.05 **Stop ramp end level**	Sets the level from where the stop ramp ends and the power to the motor is cut(voltage level for Voltage stop and torque level for Torque stop.	10 ... 99%	30%
02.06 **Stop ramp time**	Sets the time it takes for the voltage to reach end level.	1 ... 120 s	10 s
28.05 **Step down level**	Sets the level from where the stop ramp initiates.	10 ... 100 %	80 %
28.07 **Torque finish**	Sets the operational torque for Torque start ramp settings in percentage of base torque.	30...500%	100%
28.08 **Torque tune**	Sets the adjustment of resistive losses.	0...1000%	100%
28.09 **Torque ctrl gain**	Sets the speed of the voltage regulator during torque start and stop. It seldom needs to be changed, but if a dip occur in the torque curve during stop, increasing this value might solve it.	0.01 ... 10	0.04
28.10 **Torque PI intergration time**	Sets the integration time of PI controller.	0.001 ... 10 s	0.002 s
28.11 **Torque slip**	Sets the slip difference from nominal to pull-out torque in percentage.	0.1 ... 100 %	1.0 %
28.12 **Torque diff**	Sets the maximum desired difference between reference and actual torque in percentage.	0.1 ... 100 %	2.0 %
28.13 **Torque filter time**	Sets the Torque control filter time in seconds.	0.01 ... 10 s	0.02 s

7.3　Full voltage start

When using the full voltage start the softstarter shall ensure that the motor accelerates up to full speed as fast as possible. This is done by providing a full voltage start in which the motor voltage ramps up to full voltage in ½ seconds.

> ℹ️ **INFORMATION**
> Current limit is ignored for full voltage start.

Full voltage start is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.01 **Start mode**	Set to Full voltage start.	Voltage ramp, Torque ramp, Full voltage ramp	Voltage ramp

7.4　Direct stop

When using the Direct stop the output voltage to the motor is 0.

Direct stop is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.02 **Stop mode**	Set to No ramp.	No ramp, Voltage stop ramp, Torque stop ramp	Voltage ramp

7.5　Stand still brake

The Stand still brake breakes the output to the motor, and can be used during pre-start to assure that the motor is standing still before Start ramp is initiated. Stand still brake can also be controlled from a digital I/O or a fieldbus.

Stand still brake is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.07 **Pre-start function**	Set to Stand still brake.	Off, Motor heating, Stand still brake, Jog forward, Jog backward	Off
02.08 **Pre-start time**	Set the duration of the pre-start function.	0.0 ... 7200.0 s	10.0 s
07.01 **Stand still brake strength**	Set the Braking strength 10-100%. Choose a suitable value for the application.	10 ... 100%	50%

7.6 Current limit

Current limit sets a maximum value of the starting current output to the motor. The time it takes to reach full voltage can be longer than the set Start ramp Time when Current limit is enabled.

There are three different Current limit functions:

- Normal current limit
- Dual current limit
- Ramp current limit

⚠️ **WARNING**

If the load is very heavy, current limit can prevent the current to decrease below the set current level and cause overheating.

Normal current limit

When using Normal current limit and the set current limit is reached, the output voltage stays stable until the current level falls below the set current limit. Then the start ramp continues.

Dual current limit

Dual current level has two settable current limit levels. When the first current limit is reached, the current limit will keep the output voltage constant untill the configured time has passed or the current decreases. If the current decreases, the softstarter continues the voltage ramp. If the second configured Current limit time, has passed and the current has not decreased, the softstarter increases the current to the second level, and then it continues the voltage ramp. **See Figure 82.**
If the current reaches the second current limit, the softstarter will behave as for the normal current limit. Dual current limit can be used as a back-up function to prevent overheating.

Ramp current limit

When the current reaches the first current limit level the output voltage restricts the current from increasing at a maximum linearly curve up to the second current limit. The configured time determines the time it takes for the current limit to reach the second current level. When the current reaches the second current limit, the softstarter will behave as for the normal current limit. Ramp current limit can be used as a back-up function to prevent overheating.

Current limit is configured with the following parameters:

Figure 82: Dual current limit.

Parameter	Description	Setting range	Default value
03.01 **Current limit type**	Set the Current limit type.	Off, Normal, Dual, Ramp	Normal
03.02 **Current limit level**	Sets the first level to which the current is limited during start.	1.5 ... 7.5 xle	4.0 xle
03.03 **2nd curr lim level**	Sets the level of the second current limit.	1.5 ... 7.5 xle	7.0 xle
03.04 **2nd curr lim time**	Sets the time limit from the starting signal when the second current limitation will be activated.	2 ... 120 s	8 s

7.7 Kick start

Kick start function is a function to kick loose the motor initial friction during a set time and level.
If Kick start is enabled, the start ramp starts directly after Kick start. **See figure 83.**

| i | **INFORMATION**
Current limit function will not work during kick start.
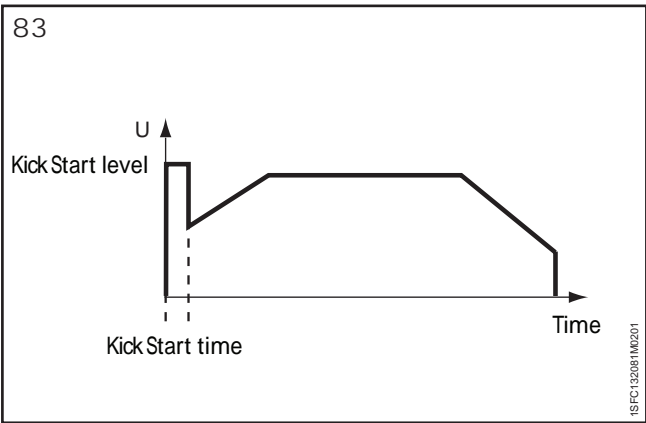
Figure 83: Kick start

Kick start is configured with the following parameters:

Parameter	Description	Setting range	Default value
04.01 **Kick start**	Enables a voltage peak at the beginning of the start ramp.	On, Off	Off
04.02 **Kick start level**	Sets the level of the Kick start in percentage of rated voltage.	50 ... 100 %	70 %
04.03 **Kick start time**	Sets the duration of the Kick start in seconds.	0.20 ... 2.00 s	0.20 s

7.8   Slow speed

Slow speed is an individual function, or a pre-start function to run the motor with low voltage output. This feature can, for example, be used to position a traverse or millband.

This function can be operated via the HMI, IO or fieldbus.

Slow speed has four pre-defined speeds:

- Fast jog

- Jog

- Creep

The motor strength can be adjusted with separate parameters. Choose a suitable value for the application.

---

i   **INFORMATION**

Too high value of the motor strength could cause oscillations and if too low the motor may not start.

It is possible to run the motor in both the forward and reverse direction, with different slow speed speeds in both directions.

When a Slow speed signal is given, the motor will accelerate up to a constant speed, that is slower than the nominal speed, for as long as the slow speed signal remains active. When the Slow speed signal is deactivated, the softstarter immediately cuts the voltage applied to the motor and the motor stops.

For navigation, see chapter 6.2.4 Motor Jog

Slow speed is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.07 **Pre-start function**	Set to Slow speed forward or Slow speed reverse.	Off, Motor heating, Stand still brake, Jog forward, Jog backward	Off
02.08 **Pre-start time**	Sets the duration of the pre-start function.	0.0 ... 7200.0 s	10.0 s
06.01 **Slow speed forward**	Sets the Slow speed forward. Fast jog forward is 33%, Jog forward is 15 % and Creep forward is 8 % of the nominal motor speed.	Fast jog, Jog, Creep	Jog
06.02 **Slow speed forward strenght**	Parameter related to the torque that is generated during Slow speed in the forward direction.	10 ... 100%	50%
06.03 **Slow speed reverse**	Sets the Slow speed reverse. Fast jog reverse is 33%, Jog reverse is 20 % and Creep reverse is 9 % of the nominal motor speed.	Fast jog, Jog, Creep	Jog
06.04 **Slow speed rev strength**	Parameter related to the torque that is generated during Slow speed in the reverse direction.	10 ... 100%	50%

7.9   Motor heating

Motor heating can be used as a pre-start function to heat the motor before actual start without any rotation to the motor. It can also be used as an individual function operated from a digital input or fieldbus.

The softstarter supplies a current to the engine, without reaching the torque level that starts the engine. This warms up the engine without starting it.

Motor heating is configured with the following parameters:

Parameter	Description	Setting range	Default value
02.07 **Pre-start function**	Set to Motor heating.	Off, Motor heating, Stand still brake, Jog forward, Jog backward	Off
02.08 **Pre-start time**	Sets the duration of the pre-start function.	0.0 ... 7200.0 s	10.0 s
06.01 **Motor heating capacity**	Sets the heating power to the motor. Choose a suitable value for the application.	10 ... 100000 W	10 W

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7.10 Sequence start

The softstarter can start up to three different motors sequentially, sequence 1, 2 and 3. This is suitable when setting up the softstarter with different applications. Choose the parameter set via input signal to the softstarter.

Parameter settings and physical connections for programmable inputs must correspond.

For connections, see chapter 5.

Parameters set for sequence start 1, 2 and 3 are equal.

If the softstarter trips for any reason, and the trip is supposed to stop the motor, all motors will be stopped.

*Example: **Start 1**, (Start mode seq 1) is configured to **Run 1** relay , (K4,K5 or K6) the relay closes when the startsignal is given, which leads to a power transfer. This can switch between softstarters and their specific parameter settings.*

Sequence start is configured with the following parameters:

Parameter	Description	Setting range	Default value
08.01 **Sequence mode**	Enable sequence start of motors.	Off, Start several motors	Off
08.02 **Ie seq 1** 08.30 **seq 2** 08.60 **seq 3**	Sets the nominal current for the motor. For good performance, it is important that the nominal current is set to the correct value. For Inside Delta connection, this parameter shall be set to 58% of the nominal motor current.	9.0 ... 1250.0 A	9.0 A
08.03 **Start mode seq 1** 08.31 **seq 2** 08.61 **seq 3**	Sets the desired start mode.	Voltage start ramp, Torque start ramp, Full voltage ramp	Voltage start ramp
08.04 **Start ramp time seq 1** 08.32 **seq 2** 08.62 **seq 3**	Sets the time it takes for the voltage to reach 100%.	1 ... 120 s	10 s
08.05 **Start ramp init lev seq 1** 08.33 **seq 2** 08.63 **seq 3**	Sets the level from where the start ramp initiates (voltage level for Voltage start and torque level for Torque start).	10 ... 99 %	30 %
08.06 **Curr lim lev seq 1** 08.34 **seq 2** 08.64 **seq 3**	Sets the level to which the current is limited during start.	0.5 ... 7.5 x I$_e$	7.0 x I$_e$
08.07 **Kick start seq 1** 08.35 **seq 2** 08.65 **seq 3**	Enables a voltage peak at the beginning of the start ramp. Information: The funciton Current Limit is not activated during Kick start.	Off, On	Off
08.08 **kick start level seq 1** 08.36 **seq 2** 08.66 **seq 3**	Sets the level of the Kick start in percentage of rated voltage.	50 ... 100 %	70 %
08.09 **Kick start lvl seq 1** 08.37 **seq 2** 08.67 **seq 3**	Sets the duration of the Kick start in seconds.	0.2 ... 2.0 s	0.2 s
08.06 **Torque lim lvl seq 1** 08.38 **seq 2** 08.68 **seq 3**	Sets the level to which the torque is limited during the start wih torque control.	20 ... 200 %	150 %
08.10 **Torque tune seq 1** 08.39 **seq 2** 08.69 **seq 3**	Adjustment of resistive losses.	0 ... 1000 %	100 %
08.11 **Torque ctrl gain seq 1** 08.40 **seq 2** 08.70 **seq 3**	Sets the speed of the voltage regulator during torque start and stop. It seldom needs to be changed, but if a dip occur in the torque curve during stop, increasing this value might solve it.	0.01 ... 10.0	0.24

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7.11 Automatic restart

The softstarter automatically restarts the motor after a fault has occurred.

The primary requirement is that if a fault or protection has been asserted, the softstarter shall automatically restart the motor in order to ensure an uninterrupted process.

The event is reset only after the Auto-reset delay time has transpired. If Auto-restart is enabled, an internal start signal is given and the fault relay is not directly activated. This is because the fault relay can sometimes be connected to a breaker located upstream.

Until a successful start is carried out, several attempts to restart are made with a fixed time interval between each. During the time between each restart, the start digital input signal is ignored.

If the fault still remain by the time a restart is made, this will be seen as a failed restart attempt.

The fault relay will only be activated after the maximum number of restarts have failed.

If a stop signal is given, the auto-restart sequence is aborted and the fault relay is not activated.

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Automatic restart is configured with the following parameters:

Parameter	Description	Setting range	Default value
09.01 **Auto-reset delay time**	Delay time after which the event is reset.	0 … 3600 s	0 s
09.02 **Auto-restart**	Enable auto-restart function.	Off,On	Off
09.03 **Auto-restart max attempts**	Max number of auto-restart attempts.	1 … 10	5

7.12   Inputs/outputs

This chapter describes input and output signals such as digital inputs, relay outputs, analog outputs, temperature inputs, and extension IO (option).

Chapter	Function
7.12.1	Digital inputs
7.12.2	Relay outputs
7.12.3	Analog outputs
7.12.4	Temperature sensor

Internal IO

Internal IO are the integrated signals to the softstarter.

The internal IO provides the following:

- 5 Digital inputs

- 3 Relay output

- 1 Analog output

Extension IO (Option)

The softstarter can be extended with more inputs and outpus by using the Extension IO module. Extension IO provides the following:

- 8 Digital input

- 4 Relay output

- 1 Analog output

To use an extension IO provides the same possibilities to use all the softstarters functions as for the programmable internal IO.

Available Extension IO. **TBD**

For example, an Extension IO is useful when a sequence start is required.

Connect the Extension IO

- Set parameter Com3 function (12.01) to Extention IO.

- Connect the DX111 or the DX122 1Ca and 1Cb to Com3 terminals.

- Use parameter group 11 to program the function of each DX111/DX122 input and output.

External digital inputs (Extention IO) is configured with the following parameters:

Parameter	Description	Setting range	Default value
12.01 **Com3 function**	Set the function of the Com3 port to Extension IO.	None, Test, Modbus RTU slave, Extension IO.	Test

7.12.1 Digital inputs (DI)

The softstarter is equipped with five digital inputs for basic control of the unit.

The five digital inputs are terminal 13,14,15,16 and 17.

The Inputs are named:

• Start

• Stop

• In0

• In1

• In2

Start and Stop inputs are fixed to start and stop function and can not be configured.

In0, In1 and In2 are programmable inputs. Functions can be related to the physical signal through a drop down menu on the HMI.

The programmable options are:

• **None** - No function on the digital input.

• **Reset** - Fault/protection reset.

• **Enable** - TBD

• **Slow speed forward** - While the digital input is high, the motor will slowly move forward.

• **Slow speed reverse** - While the digital input is high, the motor will slowly move in the reverse direction.

• **Motor heating** - While the digital input is high, the motor heating is active.

• **Stand still brake** - While the digital input is high, the stand still brake is active.

• **Start reverse** - TBD

• **User defined protection** - When activated (the protection can be programmed to be active low or high) the user defined protection will be activated.

• **Fieldbus disable control** - When the digital input is set high, the motor cannot be controlled from the fieldbus. Instead the start/stop digital input must be used, or the HMI.

• **Start 1** - Start motor 1. **See chapter 7.10 Sequence start.**

• **Start 2** - Start motor 2. **See chapter 7.10 Sequence start.**

• **Start 3** - Start motor 3. **See chapter 7.10 Sequence start.**

The inputs shall be used with 24 V and shall be of current sinking type, 10 mA. The digital input is isolated and can withstand up to 100V in potential difference between the softstarter functional earth and the earth of the interconnected system. The inputs is be possible to use both with internal 24 V or external 24 V supply.

The digital input values for respective input voltage:

"0" = 0 – 5 V

"1" = 15 – 33 V

Maximum voltage input is 33 V and minimum is -0.5 V. Outside these voltage ranges the digital value is undefined and can be either "0" or "1".

Internal digital Inputs (Internal IO) is configured with the following parameters:

Parameter	Description	Setting range	Default value
10.01 **In0 function**	Function of programmable digital input.	None, Reset, Enable, Slow speed forward, Slow speed backward, Motor heating, Stand still brake, Start reverse, User defined protection, Emergency mode, Fieldbus disable control, Start 1, Start 2, Start 3	Reset
10.02 **In1 function**		Same as In0	None
10.03 **In2 function**		Same as In0	None

External digital Inputs (extension IO) is configured with the following parameters:

Parameter	Description	Setting range	Default value
11.01 **1DI0 function**	Function of programmable digital input.	None, Reset, Enable, Slow speed forward, Slow speed backward, Motor heating, Stand still brake, Start reverse, User defined protection, Emergency mode, Fieldbus disable control, Start 1, Start 2, Start 3	Reset
11.02 **1DI1 function**	Same as 1DI0	Same as 1DI0	None
11.03 **1DI2 function**	Same as 1DI0	Same as 1DI0	None
11.04 **1DI3 function**	Same as 1DI0	Same as 1DI0	Run
11.05 **1DI4 function**	Same as 1DI0	Same as 1DI0	Top of ramp
11.06 **2DI5 function**	Same as 1DI0	Same as 1DI0	Event group 0
11.07 **2DI6 function**	Same as 1DI0	Same as 1DI0	0-10 mA
11.08 **2DI7 function**	Same as 1DI0	Same as 1DI0	Motor Current (A)

7.12.2   Relay outputs

The softstarter is equipped with three relay outputs for a configurable output signal depending of selected function. The relay outputs are, K4, K5 and K6. The relays outputs are; 30VDC/250VAC Ith = 5A , Ie= 1,5Amp (AC-15).

The relay opens and closes depending on set configurations. All relay outputs are programmable. Functions or an event group can be related to the physical signal through a drop down menu on the HMI. The programmable options for each relays are:

- **None** – No function on the relay outpt.

- **Run** – Indicates when the softstarter gives voltage to the motor.

- **Top of ramp (TOR)** – Indicates that motor runs on full voltage.

- **Event group (0-6**) – Faults, protections, warning are all selectable by customer.

- **Sequence 1-3 Run** – TBD

- **Sequence 1-3 TOR** – TBD

- **Run reverse** – TBD

As default K4 is configured to function Run, K5 to Top of ramp and K6 to Eventgroup 0.

Description of the relay terminals
Each relay has three terminals, one common terminal (COM), one normally open terminal (NO) and one normally closed terminal (NC). **See Figure 84.**

Common – TBD

Normally open – Circuit is open in normal mode (circuit is not shorted to common).

Normally closed – Circuit is in normal mode (the circuit is continuously shorted to common).

Figure 84: A contacor may for example be connected (230 volts)

Internal relay outputs (internal IO) is configured with the following parameters:

Parameter	Description	Setting range	Default value
10.04 **K4 function**	Function of programmable output relay K4. K5,K6.	None, Reset, Enable, Slow speed forward, Slow speed backward, Motor heating, Stand still brake, Start reverse, User defined protection, Emergency mode, Fieldbus disable control, Start 1, Start 2, Start 3	Run
10.05 **K5 function**	Same as K4 function	Same as K4 function	Top of ramp
10.06 **K6 function**	Same as K4 function	Same as K4 function	Event group 0

External relay outputs (extension IO) is configured with the following parameters:

Parameter	Description	Setting range	Default value
11.09 **1DO0 function**	Function of programmable output relay 1DO0 (extention IO).	None, Reset, Enable, Slow speed forward, Slow speed backward, Motor heating, Stand still brake, Start reverse, User defined protection, Emergency mode, Fieldbus disable control, Start 1, Start 2, Start 3	Run
11.10 **1DO1 function**	Same as 1DO0	Same as 1DO0	Top of ramp
11.11 **2DO2 function**	Same as 1DO0	Same as 1DO0	Event group 0
11.12 **2DO3 function**	Same as 1DO0	Same as 1DO0	Motor Current (A)

7.12.3 Analog output

The softstarter is equipped with one analog output for a configurable analog output signal to an analog meter, or the PLC.

The parameter analogue output type, AO type, can be selected to show:

- Motor current, A
- Mains voltage, V
- Active power, kW
- Active power, HP
- Reactive power, kVar
- Apparent power, kVA
- Active energy, kWh
- Reactive energy, kVArh
- cos fi
- Motor temperature, %
- Thyristor temperature, %
- Motor voltage, %
- Mains frequency, Hz
- PT100 temperature, centigrade
- PTC resistance, Ohm

The voltage or current output can be set by a configuration parameter, AO reference in the softstarter. The selection of voltage or current must be set to adapt to the analog meter or the PLC.

The settings are:

- 0-10V voltage output
- 0-10mA current output
- 0-20mA current output
- 4-20mA current output

AO is the referens to the output voltage in 0-100 % of the set parameter AO max and AO min.

Example:

- AO type is set to Motor current.
- AO reference is set to 0-10V
- AO min to 0, and AO max to 3000.

This means that when the motor current is:

- 3000 A, the output voltage will be 10V.
- 0 A, the output voltage will be 0 V.
- 1500 A, the output voltage will be 5 V.

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Internal Analog output is configured with the following parameters:

Parameter	Description	Setting range	Default value
10.07 **AO reference**	Sets the Analog output reference.	0-10mA, 0-20mA, 4-20mA, 0-10V	4-20mA
10.08 **AO type**	Sets the Analog output type.	Motor current, Mains voltage, Active power, Active power, Reactive power, Apparent power, Active energy,Reactive energy, cos fi, Motor temperature, Thyristor temperature, Motor voltage, Mains frequency, PT100 temperature, PTC resistance	Motor current [A]
10.09 **AO max value**	Sets the max analog output value.	0,0 ... 1000000	500
10.10 **AO min value**	Sets the min analog output value.	0,0 ... 1000000	0

External Analog output (Extension IO) is configured with the following parameters:

Description	Description	Setting range	Default value
11.13 **1AO0 reference**	Sets the Analog output reference.	0-10mA, 0-20mA, 4-20mA, 0-10V	4-20mA
11.14 **1AO0 type**	Sets the Analog output type.	Motor current, Mains voltage, Active power, Active power, Reactive power, Apparent power, Active energy,Reactive energy, cos fi, Motor temperature, Thyristor temperature, Motor voltage, Mains frequency, PT100 temperature, PTC resistance	Motor current [A]
11.15 **1AO0 max value**	Sets the max Analog output value.	0,0 ... 1000000	500
11.16 **1AO0 min value**	Sets the min Analog output value.	0,0 ... 1000000	0

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7.12.4 Temperature sensor

Temperature inputs

There is one temperature input. The user can set three different types of temperature sensors:

- PTC
- PT100
- Bi-metal switch

These can be connected to different protections. A protection can be set to switch on if a particular temperature occurs.

PTC

The PTC temperature input can measure a motor temperature in the range of -25° to 250°. The PTC measuring shall follow the standard for a Mark-A detector according to IEC60947-8.

The temperature control system has a short circuit detector that will detect if the input resistance is less than 10 ohm. This detector will only work if the total length of the connected cable is less than 10 ohm i.e. about 140 m with 0,5 mm² cable, 240m with 1,0 mm² cable and 440m with 1,5 mm². If a short circuit is detected then the error is reported to the user.

It is possible to detect if a sensor is connected to the softstarter.

It is also possible to enable the temperature measurement and to manual reset, automatic reset or get indication only.

PT100

The softstarter has a 3-wire PT100 input that can be combined and share terminals with the PTC input.

The trip temperature is set by the user. The maximum trip temperature is 250° and lowest is -25°.

The PT100 measuring shall have an accuracy of +/-3° with three wires measuring if the three connecting cables have the same resistance.

If a short circuit is detected then the error is reported to the user. The softstarter is also be able to detect if a sensor is connected to the softstarter.

It is possible to enable the temperature measurement. It is also possible to perform a manual reset, automatic reset or to indications only.

Bi-metal switch

It is possible to combine temperature input with bi-metal switches or thermo click elements for detecting over temperature. These temperature sensors behave like a switch that opens or close at the trip temperature. Both types (NO – normally open or NC – normally closed) is supported and short circuit detection must be turned off since it is not applicable. The maximum current through the bi-metal switches is 100 mA.

Temperature sensor is configured with the following parameters: See chapter 7.14.14

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7.13 Fieldbus

PSTX has one Anybus port, one fieldbus plug adaptor port (FBPA), and one Modbus RTU port. Only one bus at the time can be used. i.e. the user cannot connect the softstarter to multiple fieldbuses.

The port used for Modbus RTU is a multifunction port that can also be used for connecting an Extension IO module. If an Extension IO module is required it is not possible to use the port for Modbus RTU, use an Anybus Modbus RTU module instead.

In the IP-based fieldbuses, such as Modbus TCP, the user have to specify IP address, gateway, subnet mask and DHCP client.

Fieldbus type

When fieldbus communication is used, the present type of fieldbus must be selected.The following fieldbus types are available in the softstarter:

- Modbus-TCP

- Modbus-RTU

- DeviceNet

- Profibus

- EtherNet/IP

Fieldbus control

If the softstarter is going to be used with fieldbus communication, the fieldbus interface must be enabled before any action can be taken.

Fieldbus address

If the softstarter is going to be used with fieldbus communication, set a fieldbus address for the softstarter. Select a suitable, and unoccupied number as the address.

⚠ **CAUTION**

The motor may start unexpectedly if there is a start signal present when performing any of the actions listed below.

- Switching from one type of control to another (fieldbus control / hardwire control).

- Remember that when Fieldbus auto disable is active, this switch can be done automatically.

- Re-programming of the programmable inputs.

- Reset all Settings (programmable input set to Enable).

Fieldbus auto disable

With fieldbus auto enabled, the control of the softstarter will automatically switch over from the fieldbus to the hard wire inputs, if the fieldbus malfunctions for instance due to power loss or broken cable. When the fieldbus starts working again, the control is automatically switched back to the fieldbus.

Fieldbus Inputs/Outputs

Functions set in the softstarter as Fieldbus digital inputs (DI) are in fact the digital inputs to the PLC i.e. the data flow from the softstarter through the network to the PLC.

Fieldbus digital outputs (DO) are not configurable. The output (DO) describes data flow from the network to the softstarter i.e. appears as an input, from the softstarter point of view.

Fieldbus communication is configured with the following parameters:

Parameter	Description	Setting range	Default value
12.01 **Com3 function**	Sets the function of the Com3 port.	None, Test, Modbus RTU slave, Extension IO	Test
12.02 **FB interface connector**	Sets the Fieldbus interface selection.	FbPlug, Modbus RTU, Anybus, None	None
12.03 **Fieldbus control**	Enables control from fieldbus.	Off, On	Off
12.04 **Fieldbus address**	Sets the Bus address.	0 ... 65535	0
12.05 **Fieldbus ip address**	Fieldbus IP: Sets the IP-address.	0.0.0.0 ... 255.255.255.255	0.0.0.0
12.06 **Fieldbus ip gateway**	Fieldbus IP: Sets the default gateway.	0.0.0.0 ... 255.255.255.255	0.0.0.0
12.07 **Fieldbus ip netmask**	Fieldbus IP: Sets the netmask.	0.0.0.0 ... 255.255.255.255	255.255.255.0
12.08 **Fieldbus ip dhcp client**	Fieldbus IP: Enables dhcp.	Off, On	Off
12.09 **FB baud rate***	Sets the baud rate of internal Modbus-RTU interface, Anybus DeviceNet and Anybus Modbus-RTU.	1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 125000, 250000,500000, Auto	* There are restrictions on which baudrates that can be used for different protocols. See separate Table below.
12.10 **FB parity**	Sets parity for Anybus Modbus-RTU.	No parity, Odd parity, Even parity	Even parity
12.11 **FB stop bits**	Select stop bits for Anybus Modbus-RTU.	1 Stop bit, 2 Stop bits	1 Stop bit
12.12 **Fieldbus DI 1**	Sets the DI 1 programmable digital input signal.	Emergency mode feedback, Event group 0 ... 6 status, Fault reset feedback, Line, Motor heating feedback, None, Phase sequence, Run reverse status, Run status, Sequnce 1 ... 3 Run status, Sequence 1 ... 3 TOR status, Slow speed rev feedback, Slow speed forw feedback, Stand still brake feedback, Start 1 ... 3 feedback, Start feedback, Start reverse feedback, Stop feedback, TOR status, User defined feedback	Line
12.13 **Fieldbus DI 2**	Sets the DI 2 programmable digital input signal.		Phase sequence
12.14 **Fieldbus DI 3**	Sets the DI 3 programmable digital input signal.		Event group 0 status
12.15 **Fieldbus DI 4**	Sets the DI 4 programmable digital input signal.		Eventgroup 1 status
12.16 **Fieldbus DI 5**	Sets the DI 5 programmable digital input signal.		Start feedback
12.17 **Fieldbus DI 6**	Sets the DI 6 programmable digital input signal.		Stop feedback
12.18 **Fieldbus DI 7**	Sets the DI 7 programmable digital input signal.		Eventgroup 2 status
12.19 **Fieldbus DI 8**	Sets the DI 8 programmable digital input signal.		Eventgroup 3 status
12.20 **Fieldbus DI 9**	Sets the DI 9 programmable digital input signal.		Eventgroup 4 status
12.21 **Fieldbus DI 10**	Sets the DI 9 programmable digital input signal.		Eventgroup 5 status

Parameter	Description	Setting range	Default value
12.22 **Fieldbus AI 1**	Sets the AI 1 programmable analog input signal.	Phase L1, L2, L3 current, Active energy (resettable), Active power, Active power (HP), Apparent power, EOL time to cool, EOL time to trip, Mains voltage, Power factor, Motor voltage, Mains frequency, Motor connection Max phase current, Motor current, Motor current percent, Motor run time (resetable), Motor temperature, Motor temperature percent, None, Number of starts (resettable), Phase sequence, PT100 temperature, PTC resistance, Reactive energy (resettable), Reactive power, Thyristor run time (resettable), Remaining time to start, Thyristor temperature, Thyristor temperature percent, Top event code	Motor connection
12.23 **Fieldbus AI 2**	Sets the AI 2 programmable analog input signal.		Phase L2 current
12.24 **Fieldbus AI 3**	Sets the AI 3 programmable analog input signal.		Phase L3 current
12.25 **Fieldbus AI 4**	Sets the AI 4 programmable analog input signal.		Max phase curent
12.26 **Fieldbus AI 5**	Sets the AI 5 programmable analog input signal.		Mains frequency
12.27 **Fieldbus AI 6**	Sets the AI 6 programmable analog input signal.		Motor voltage
12.28 **Fieldbus AI 7**	Sets the AI 7 programmable analog input signal.		Motor temperature
12.29 **Fieldbus AI 8**	Sets the AI 8 programmable analog input signal.		Number of starts (resettable)
12.30 **Fieldbus AI 9**	Sets the AI 9 programmable analog input signal.		Motor run time (resettable)
12.31 **Fieldbus AI 10**	Sets the AI 10 programmable analog input signal.		Top event code

* Restrictions on which baudrates that can be used for different protocols.

Baudrate	Modbus RTU on Com 3	Modbus RTU Anybus	Devicenet on Anybus
1200		x	
2400		x	
4800		x	
9600	x	x	
19200	x	x	
38400		x	
57600		x	
76800		x	
115200		x	
125000			x
250000			x
500000			x
Autobaud			x

7.14 Event groups

Event groups consists of supervision functions divided in seperat lists in the HMI.

Supervision functions are functions to indicate when an event occurrs to the motor.

There are three different types of supervision functions:

- Faults

- Warnings

- Protections

The supervision functions generate events based on different conditions in the motor and in the softstarter itself. Each individual event can be assigned to one or more Event groups. An Event group can be mapped to a relay output or/and a fieldbus signal.

For each supervision function there is a parameter for assigning the corresponding event to one or more Event groups.

In PSTX there are seven Event groups, numbered from 0 to 6. All event functions are set as default to one Event group.

There are seven event groups that can be used in whatever way appropriate to the user. Event groups 4-6 will be completely unassigned by default and are convenient to use for custom applications. The other groups will have (or may have in the future) events assigned to them by default.

Example: **TBD**

7

7.15 Protections

The softstarter is equipped with a number of protection functions to protect the softstarter, motor and other equipments.

A protection can be completely turned off, configured to stop the motor, or indicate that the event has occurred. There are two options if the protection shall stop the motor: either a manual reset is required, or the softstarter will automatically reset the protection when the protection goes inactive, i.e. when the conditions that triggered the event are gone.

In addition to the type of operations mentioned above, which are avilable for all protections, some protections have more options.
When the protection acts as a warning, it will indicate that something is wrong.
When the protection acts as a fault, it will stop the motor when fault occur (Direct stop).

Protections can be enabled or disabled by the user.
The protection parameters can only be configured if the protection is activated.

When any of the protections signals a risk of damage, the following basic actions will be performed:

- Protection LED will light up

- The type of event is displayed

- The type of event is logged on the event list

Protections can be set to have automatic reset or manual reset. For every protection, there is parameter options called **Operation**, which can be set as:

- **Stop-Automatic** – The engine stops and reset automatic after the fault condition has been corrected*.

- **Stop-Manual –** The engine stops and have to be reset manually after the fault condition has been corrected*.

- **Off**

- **Indication**

  * You cannot reset a fault before the fault condition is corrected. Example: If **stop-manual** is set at **EOL Fault** (engine is too warm) you can only reset the softstarter once the engine has cooled down to the right temperature.

Protections can be set to an Event group by a parameter option called **Out**. The Event group can be configured for relay output to control other devices in an application.

As default all parameters are set to one Eventgroup.

7.15.1 EOL Protection

The motor has been overloaded because of too high
current over a certain time. Check starting conditions and
EOL settings.

**EOL protection is configured with the following
parameters:**

Parameter	Description	Setting range	Default value
13.01 **EOL mode**	Set the EOL mode to Normal or Dual.	Normal/ Dual	Normal
13.02 **EOL class**	Sets the EOL trip class.	10 A, 10, 20, 30	10
13.03 **EOL dual class**	Sets the protection class used when in top of ramp. This parameter is only applicable when EOL protection mode is set to dual.	10 A, 10, 20, 30	10 A
13.04 **EOL out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ...6	2
13.05 **EOL operation**	Sets the operation of this protection.	Off, Stop-Manual, Stop-Automatic, Indication	Stop-Manual

7.15.2 Locked rotor protection

The motor is running stiff. A damaged bearing or a
stucked load could be possible causes.
This protection is only operational in the top of ramp state.
Check the load and the motor.

**Locked rotor protection is configured with the
following parameters:**

Parameter	Description	Setting range	Default value
13.06 **Locked rotor level**	Set the locked rotor trip level	0.5 ... 8.0 x I_e	4.0 x I_e
13.07 **Locked rotor trip time**	Sets the time that the current has to be above the trip level to trip.	1.0 ... 30.0 s	1.0 s
13.08 **Locked rotor delay time**	Sets the time after top of ramp that the protection is enabled.	0.2 ... 10.0 s	5.0 s
13.09 **Locked rotor out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
13.10 **Locked rotor op**	Sets the operation of this protection.	Off, Stop-Manual, Stop-Automatic, Indication	Off

7.15.3 Max number of starts protection

TBD

**Max number of starts protection is configured with the
following parameters:**

Parameter	Description	Setting range	Default value
13.11 **Max no of starts per hour**	Sets the limitation in number of starts per hour.	1 ... 100	6
13.12 **Max no of starts per hour out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
13.13 **Max no of starts per hour op**	Sets the operation of this protection.	Off, Stop-Manual, Stop-Automatic, Indication	Off

7.15.4 Current underload protection

The motor current has fallen below the settable value.
The voltage to the softstarter is too low. The protection
measures voltage and checks if the voltage is too low, if it
is too low, the softstarter will trip.

This protection is only operational in the Top of ramp
state.

Check that the motor current parameter (Ie) is set
correctly.

**Current underload protection is configured with the
following parameters:**

Parameter	Description	Setting range	Default value
14.01 **Curr underload level**	Sets the Current underload trip level.	0.3 ... 0.9 x I_e	0.3 x I_e
14.02 **Curr underload trip time**	Sets the time that the current has to be below the trip level to trip.	0 ... 10 s	1 s
14.03 **Curr underload delay time**	Sets the time after Top of ramp that the protection is enabled.	0 ... 30 s	10 s
14.04 **Curr underload out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
14.05 **Curr underload op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication	Off

7.15.5 Power factor underload protection

The power factor has fallen below the normal level.

The Power factor underload protection can be used to
supervise the load of the motor. If the load decreases the
power factor will decrease as well.

This protection is only operational in the Top of ramp
state.

**Power factor underload protection is configured with
the following parameters:**

Parameter	Description	Setting range	Default value
14.06 **Pwr factor underload level**	Sets the Power factor underload trip level.	0.0 ... 1.0	0.7
14.07 **Pwr factor underload trip time**	Sets the time that the Power factor has to be below the trip level to trip.	0 ... 10 s	1 s
14.08 **Pwr factor underload delay time**	Sets the time after Top of ramp that the protection is enabled.	0 ... 30 s	10 s
14.09 **Pwr factor underload out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
14.10 **Pwr factor underload op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.6 Current imbalance protection

This protection detects if there is imbalance in the currents. Normally it should be same current amount in all three phases. If the current amount is different in the phases the engine can go bumpy.
This protection is only operational in the Top of ramp state.

Current imbalance protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
14.11 **Curr imb level**	Sets the Current imbalance trip level.	10 ... 80 %	80 %
14.12 **Curr imb trip time**	Sets the time that the Current imbalance has to be below the trip level to trip.	1 ... 30 s	10 s
14.13 **Curr imb delay time**	Sets the time after Top of ramp that the protection is enabled.	1 ... 30 s	30 s
14.14 **Curr imb out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ...6	2
14.15 **Curr imb operation**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.7 Over voltage protection

This proection detects if the main voltage is too high.
Check the main voltage. This protection is not operational in the Standby state.

Over voltage protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
15.01 **Over voltage level**	Sets the Over voltage trip level.	170 ... 850 V	850 V
15.02 **Over voltage trip time**	Sets the time that the voltage has to be above the trip level to trip.	0.1 ... 100.0 s	1.0 s
15.03 **Over voltage out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
15.04 **Over voltage op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.8 Under voltage protection

This protection detects if the main voltage is too low.
Check the main voltage.

Under voltage protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
15.05 **Under voltage level**	Sets the Under voltage trip level.	170 ... 850 V	208 V
15.06 **Under voltage trip time**	Sets the time that the voltage has to be below the trip level to trip.	0.1 ... 100.0 s	1.0 s
15.07 **Under voltage op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off
15.08 **Under voltage out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2

7.15.9 Voltage imbalance protection

This protection detects voltage imbalance. Normally there is the same voltage in all three phases. If the voltage is different in the phases, the engine can run bumpy.

Check the main voltage and restart the motor.

Voltage imbalance protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
15.09 **Voltage imb level**	Sets the Voltage imbalance trip level.	1 ... 100 %	10 %
15.10 **Voltage imb out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	0000010
15.11 **Voltage imb op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.10 Phase reversal protection

This protection detects if if the phases are connected incorrectly.
The order in which the phases are connected to the in-stream power has no effect on the softstarter. But it may be relevant to the component which is connected to the softstarter. An engine can for example run in the wrong direction if the phases are connected incorrectly. This protection detects if the phases are connected in the wrong order and then prevents the engine from starting.

Check the phase sequence on the line side to L1-L2-L3.

Phase reversal protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
16.01 **Phase rev out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	0000010
16.02 **Phase rev operation**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.11 Frequence range protection

TBD

Frequnce range protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
16.03 **Freq range lower trip lvl**	Sets the lower trip level for the frequency.	40 ...72 Hz	45 Hz
16.04 **Freq range upper trip lvl**	Sets the upper trip level for the frequency.	40 ...72 Hz	60 Hz
16.05 **Freq range trip time**	Sets the time that the frequency has to be outside the trip range to trip.	0 ... 60 s	1 s
16.06 **Freq range out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
16.07 **Freq range op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.12 By-pass open protection

This protection detects if the By-pass contactor or relay has not closed when Top of ramp is reached.
Contact ABB sales office for service.

By-pass open protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
16.08 **By-pass open out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
16.09 **By-pass open operation**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.13 Voltage outputs protection

This protection detects if the 24 V voltage outputs has been overloaded or shorted. Check the connections.

Voltage outputs protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
16.10 **Voltage outputs out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
16.11 **Voltage outputs op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.14 Temperature sensors

7.15.14.1 External thermal sensor - PTC protection

The external thermal sensor has detected a temperature higher than the trip level.
The softstarter has a temperature input where a PTC element can be connected.
This can be configured to trip if it goes above a certain temperature. Check the root cause of the overheating.

External thermal sensor - PTC protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
10.11 **Ext therm sensor - ID**	Sets the External thermal sensor modes.	No sensor, PTC, PT100-3Wire, PT100-2Wire, Thermistor switch.	No sensor
17.01 **PTC out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
17.02 **PTC op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.14.2 External thermal sensor - PT100 protection

The external thermal sensor has detected a temperature higher than the trip level.
The softstarter has a temperature input where a PTC element can be connected. This can be configured to trip if it goes above a certain temperature.

Check the root cause of the overheating.

External thermal sensor - PT100 protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
10.11 **Ext therm sensor - ID**	Sets the External thermal sensor modes.	No sensor, PTC, PT100-3Wire, PT100-2Wire, Thermistor switch.	No sensor
17.03 **PT100 2wire res**	Sets the two wire resistance for PT100.	0 ... 100 Ohm	100 Ohm
17.04 **PT100 trip temp**	Sets the PT100 trip temperature level.	-50° ... 250°	60°
17.05 **PT100 PT100 reset temp**	Sets the PT100 reset temperature.	-50° ... 250°	40°
17.06 **PT100 out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
17.07 **PT100 op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.15 User defined protection

Programmable digital input can be used in combination with external device/sensor to provide to the customer the possibility of handling their own defined protection.

User defined protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
18.01 **User defined DI status**	Sets if the signal is active high or active low.	0 ... 1	1
18.02 **User defined trip time**	Sets the time to trip.	0.0 ... 60.0 s	1.0 s
18.03 **User defined out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
18.04 **User defined op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.16 Earth fault protection

Programmable digital input can be used in combination with external device/sensor to provide the possibility of handling their own defined protection.
This protection detects if the absolute value of the sum of the three line currents is too high, which indicates that there is an earth fault.

Note that the currents measurements in the softstarter is not accurate or fast enough to protect people. The only purpose of this function is to protected equipment.

Earth fault protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
18.05 **Earth fault trip time**	Sets the trip time for the earth fault protection.	0.1 ... 1.0 s	0.5 s
18.06 **Earth fault out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
18.07 **Earth fault op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.17 Too long current limit protection

This protection detacts if the current limit has exceeded the set value. The starting condition is too heavy for the set current limit. Check starting conditions and parameters.

Too long current limit protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
18.08 **Too long curr lim trip time**	Sets the trip time for the too long time at current limit protection.	1 ... 600 s	10 s
18.09 **Too long curr lim out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
18.10 **Too long curr lim op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.18 HMI failure protection

This protection detacts if there is communication disturbance between the softstarter and the HMI.
If the communication with the HMI is lost for more than approximatlely 600 ms this protection is activated.
This protection has a special action in addition to the common types of operation:
Switch to I/O-control.

HMI failure protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
19.01 **HMI failure out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
19.02 **HMI failure op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.19 Fieldbus failure protection

This protection detacts if there is a communication disturbance between the softstarter and the PLC.

If the softstarter is normally controlled over the fieldbus, the fieldbus failure protection parameter specifies what will happen.
This protection has a special action in addition to the common types of operation:
Switch to I/O-control.

Fieldbus failure protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
19.03 **Fieldbus failure out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
19.04 **Fieldbus failure op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.15.20 Extension IO failure protection

This protection detacts if there is communication disturbance between the softstarter and the Extension I/O module.

Extension IO failure protection is configured with the following parameters:

Parameter	Description	Setting range	Default value
19.05 **Ext IO failure trip time**	Sets the trip time for extension IO failure protection.	300 ... 30000 ms	1000 ms
19.06 **Ext IO failure out**	Specifies the Event groups this protection belongs to.	Eventgroup 0 ... 6	2
19.07 **Ext IO failure op**	Sets the operation of this protection.	Off, Stop manual, Stop auto, Indication.	Off

7.16 Warnings

The softstarter is equipped with a number of warning functions to signal malfunctioning or other potential risks, before asserting the protection or fault. The difference between a warning and a protection is that a warning cannot stop the softstarter and a reset of a warning is not necessary.The warning level and any other additional information needed to enable the warning can be set by the user.

A warning will be logged in the event list when it occurs. Warnings can be Enable or Disable. There is also a percentage setting were the user can set at which percentage level the warning shall occur. The percentage setting is within 10 - 80 %.

Warnings can be set to an Event group by a parameter option called Out. The Event group can be configured for relay output to control other devices in an application. As default, all parameters are set to one Eventgroup.

Warnings are displayed on the HMI, but otherwise they do not affect the behaviour of the softstarter.

7.16.1 Electronic overload warning

A warning signal will be given if the motor temperature exceeds the settable warning level, % of max temperature.

**Electronic overload warning
is configured with the following parameters:**

Parameter	Description	Setting range	Default value
20.01 **EOL level**	Sets the EOL warning level.	40.0 ... 99.0 %	90.0 %
20.02 **EOL out**	Specifies the Event groups this warning belongs to.	Event group 0 ... 6	4
23.03 **EOL warning**	Enables EOL warning.	Off, On	Off

7.16.2 Locked rotor warning
A warning signal will be given if the current exceeds the settable warning level.

The motor is running stiff. A damaged bearing or a stuck load could be possible causes. Check the load and the motor.

Locked rotor warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
20.04 **Locked rotor level**	Sets the Locked rotor warning level.	0.2 ... 10.0 x I_e	3.0 x I_e
20.05 **Locked rotor init time**	Sets the time delay after top of ramp when the warning is enabled.	1.0 ... 30.0 s	1.0 s
20.06 **Locked rotor out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
20.07 **Locked rotor**	Enables locked rotor warning.	Off, On	Off

7.16.3 Thyristor overload warning

A warning signal will be given if the thyristor temperature has exceeded the settable warning level. The warning says that the softstarter is approaching overheating value and will tripp if the heat is not removed.

Check the starting conditions and the fans.
Increase current limit if needed.

Thyristor overload warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
20.08 **Thyristor OL out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
20.09 **Thyristor OL**	Enables thyristor overload warning.	Off, On	Off

7.16.4 Current underload warning

A warning signal will be given if the line current decreases below the settable value during continuous operation.

Check that the motor current parameter (Ie) is set correctly.

Current underload warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
21.01 **Curr underload level**	Sets the Current underload warning level.	0.4 ... 1.0 x I_e	0.4 x I_e
21.02 **Curr underload trip time**	Sets the time that the current has to be under the Warning level to trip.	0 ... 30 s	5 s
21.03 **Curr underload delay time**	Sets the time delay after Top of ramp when the warning is enabled.	0 ... 10 s	1 s
21.04 **Curr underload out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
21.05 **Curr underload**	Enables Current underload warning.	Off, On	Of

7.16.5 Power factor underload warning

A warning signal will be given if the power factor is below the settable warning level.

Power factor underload warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
21.06 **Pwr factor underload level**	Sets the Power factor underload limit.	0.0 ... 1.0	0.5
21.07 **Pwr factor underload trip time**	The time it has to be below limit until trip in seconds.	0 ... 30 s	5 s
21.08 **Pwr factor underload delay time**	The time until diagnoser starts to work in Top of ramp.	0 ... 10 s	1 s
21.09 **Pwr factor underload out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
21.10 **Pwr factor underload**	Enables Power factor underload warning.	Off, On	Off

7.16.6   Current imbalance warning

A warning signal will be given if the phase imbalance between the currents is higher than the set value, The difference in current between phases is measured in %.

Restart the motor and check the main currents and voltage.

Current imbalance warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
21.11 **Current imb level**	Sets the Current imbalance warning level.	10 ... 80 %	70 %
21.12 **Current imb out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
21.13 **Current imbalance**	Enables the Current imbalance warning.	Off, On	Off

7.16.7   Over voltage warning

A warning signal will be given if the voltage is higher than the set value. Check the main voltage.

Over voltage warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
22.01 **Over voltage level**	User configured warning level in Volts.	208 ... 850 V	208 V
22.02 **Over voltage trip time**	User configured time until warning in seconds.	0.1 ... 100.0 s	1.0 s
22.03 **Over voltage out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
22.04 **Over voltage**	Parameter to enable Over voltage warning.	Off, On	Off

7.16.8   Under voltage warning

A warning signal will be given if the main voltage is higher than the set warning level. Check the main voltage.

Under voltage warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
22.05 **Under voltage level**	User configured warning level in Volts.	208 ... 850 V	208 V
22.06 **Under voltage trip time**	User configured time until warning in seconds.	0.1 ... 100.0 s	1.0 s
22.07 **Under voltage out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
22.08 **Under voltage**	Parameter to enable Under voltage warning.	Off, on	Off

7.16.9   Voltage imbalance warning

A warning signal will be given if the voltage imbalance between the phases is higher than the set warning level.

Check the main voltage.

Voltage imbalance warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
22.09 **Voltage imb level**	The warning level is specified in %.	1 ... 100	5
22.10 **Voltage imb out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 .. 6	4
22.11 **Voltage imbalance**	Enables Voltage imbalance warning.	Off, On	Off

7.16.10 Electronic overload time-to-trip warning

A warning signal will be given if the predicted time before EOL trip has fallen below the set warning level.

Electronic overlad time-to-trip warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
23.01 **EOL time-to-trip time**	Sets how long time before the EOL protection trips the warning is activated.	1 ... 1000 s	5 s
23.02 **EOL time-to-trip out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
23.03 **EOL time-to-trip**	Enables EOL time to trip warning.	Off, On	Off

7.16.11 Total Harmonic Distortion (THD) warning

A warning signal will be given if the actual power system voltage differ from the ideal sine wave. THD has exceeded the warning level.

Check the quality of the network.

Total Harmonic distortion (THD) warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
23.04 **THD(U) level**	Sets the warning level for Total Harmonic Distortion (U).	1 ... 100 %	10 %
23.05 **THD(U) out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
23.06 **THD(U)**	Enables Total Harmonic Distortion warning.	Off, On	Off

7.16.12 Short circuit warning

A warning signal will be given if there is an internal short circuit and the softstarter is running in limp mode.
Contact ABB sales office for service.

Short circuit warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
23.07 **Short circuit out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
23.08 **Short circuit**	Enables Short circuit warning.	Off, On	Off

7.16.13 Number of starts limits

A warning signal will be given if the number of starts exceeds the configured trip level. The number of starts counter can be reset to zero from the HMI.
The purpose of the warning is to allow for planed maintenance of the equipment based on number of starts.

Number of starts limits warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
24.01 **Number of starts lim**	Sets the total number of starts that will activiate a warning. This can for example be used when identifying a need for service or maintanance.	1 ... 65535	65535
24.02 **Number of starts out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
24.03 **Number of starts**	Enables Number of starts limits warning level.	Off, On	Off

7.16.14 Fans fault warning

A warning signal will be given if the fans are not working properly. There could be dust or other mechanical blocking in the softstarter fans. Risk of overheating.
Contact ABB sales office for service.

Fans fault warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.04 **Faulty fan out**	Specifies the Event groups this warning belongs to.	Eventgroup 0 ... 6	4
25.05 **Faulty fan**	Enables Faulty fan warning.	Off, On	Off

7.16.15 Modbus configuration warning

A warning signal will be given if the built-in Modbus RTU slave is enabled (parameter 12.02) but the Com3 function is not set to Modbus RTU slave. To use modbus RTU, the RTU slave must be enabled and the Com3 port must be configured to be used for the Modbus RTU slave.

Modbus configuration warning is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.06 **Modbus_RTU w/o auxport out**	Specifies the Event groups this warning belong to.	Eventgroup 0 ... 6	4

7.17 Faults

The softstarter is equipped with a number of fault detection functions to protect the softstarter.
Faults detection is always running as default and cannot be turned of by the user. If a signal is malfunctioning in the softstarter, the motor or in the power network level, a fault will occur. Supervised faults can be divided in internal and external faults.

Internal fault:

There has been a fault in equipment connected to the softstarter, **see chapter 10 Troubleshooting**, and contact ABB sales office if necessary.

External fault:

There has been a fault **in** the softstarter, **see chapter 10 Troubleshooting**, and contact ABB sales office if necessary.

When a fault occur, the type of fault will be described on the home screen, the red Fault LED light will illuminate, and the powersupply to the motor which is connected to the softstarter will be turned of (Direct stop).

When any of the faults are detected these basic actions will be performed:

- Fault LED will light up

- The type of event is displayed

- The type of event is logged on the event list

Faults cannot be configured in other way then to set the reset mode to stop-automatic or stop-manual.

Faults can be set to have automatic reset or manual reset. For every fault, there is parameter options called **Operation**, which can be set as:

- **Stop-Automatic** – The engine stops and resets automatically after the fault condition has been corrected*.

- **Stop-Manual –** The engine stops and has to be reset manually after the fault condition has been corrected*.

  * Faults cannot be reset before the fault condition is corrected.
  Example: If stop-manual is set at EOL Fault (engine is too warm) the softstarter can only be reset once the engine has cooled down to the right temperature.
  When the engine has reached below a certain temperature, the fault condition will be gone, and then reset. The fault will be cleared from the fault list and the engine can be started again.

Faults can be set to an Event group by a parameter option called Out. The Event group can be configured for relay output to control other devices in an application.

As default all parameters are set to one Eventgroup.

At occurrence, the following action is decided based on user preference:

- Stop motor and manually reset is required

- Stop motor and automatic reset is performed

- Only indication will be given (fire pump mode only)

- Auto-restart possibilities

In addition to the basic actions, depending on the fault, further actions can be added or the basic actions can be modified. If several faults occur they are all stored in a sequence and an individual reset for each fault must be done if manual reset is selected.

Fire pump – Faults disabled:
The normal operation of the softstarter when a fault is detected is to do a direct stop.

If the the Fire pump is enabled and a fault is detected, the softstarter will try to run the motor according to the start and stop signals, ignore safety, and continue to run regardless of consequences.

The softstarter can manage to run the motor depending on what fault is detected.

7.17.1   Internal faults

7.17.1.1   Shunt fault
The softstarter has been shorted and can not stop the power down to the motor when it is connected in-line, the motor can not be turned off.
If the user puts shunt fault on one relay and connect it to a line contactor or a circuit breaker, the user can break off the motor.

Contact ABB sales office for service.

Shunt fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.01 **Shunt fault out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
25.02 **Shunt fault op**	Sets the operation of this fault.	Stop manual, Stop auto.	Stop manual

7.17.1.2 Short circuit fault

The softstarter has a short circuit or By-pass. The softstarter can run in Limp mode function, even if one phase become shorted.

If one or several thyristors are shorted, Contact ABB sales office for service.

Short circuit fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.03 **Short circuit out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
25.04 **Short circuit fault op**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manual

7.17.1.3 Open circuit thyristor fault

The softstarter cannot close one or more thyristors.

Open circuit thyristor fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.05 **Open circuit thyr out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
25.06 **Open circuit thyr out**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manual

7.17.1.4 Thyristor overload fault

The thyristors in the softstarter are overloaded.
If the estimated thyristor junction temperature exceeds the maximum allowed value, this fault is signaled, to protect thyristors from overheating.

Check the starting conditions and the fans.

Increase current limit if needed.

Let the thyristors cool down before restart.

Thyristor overload fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.07 **Thyristor OL out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
25.08 **Thyristor OL op**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manual

7.17.1.5 Heat sink over temperature

The sofstarter measures the heat sink temperature. If the temperature gets to high this fault is signaled. The purpose of the heat sink is to cool the thyristors.

Heat sink over temperature fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.09 **Heat sink over temp out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
25.10 **Heat sink over temp op**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manual

7.17.1.6 Unspecified fault

This fault is a grouping of several internal faults that are quite unlikely and does not need to specified as individual faults.

Unspecified fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
25.11 **Unspecified fault out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 .. 6	1
25.12 **Unspecified fault op**	Set the operation of this fault.	Stop manual, Stop auto	Stop manual

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7.17.2   External faults

7.17.2.1   Phase loss fault

Voltage to one or more phases missing. For example, this detects an open line contactor.
Check that the mains are connected. Check that no line contactor or breaker is open.

Phase loss fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
26.01 **Phase loss out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
26.02 **Phase loss op**	Set the operation of this fault.	Stop manual, Stop auto	Stop manual

7.17.2.2   Bad network fault

Bad network quality fault is signaled if there is too much frequency disturbance in the network. Then it will be too dificult to control the triggering of the thyristors in a safe way.
Check for harmonics or frequency disturbance in the supply network.

Bad network fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
26.03 **Bad network out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
26.04 **Bad network op**	Set the operation of this fault.	Stop manual, Stop auto	Stop manual

7.17.2.3   Low supply voltage fault

Too low control supply voltage on terminals 1 and 2.
A fault signal will be given if the softstarter detects that the control supply voltage is too low. Then it will stop the motor and save unsaved data. However, if the control supply voltage goes up before the softstarter is completely turned off, the low supply voltage fault will be activated. If the voltage is too low, it can no longer assure proper function of the softstarter and this fault is signaled. This fault can only be asserted after some time, since low voltage will also be detected when the softstarter is unplugged and shutdown.

Check for voltage dips or interruptions.

Low supply fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
26.05 **Low supply voltage out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
26.06 **Low supply voltage op**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manual

7.17.2.4 High current fault

A fault signal will be given if the motor current exceeds the fixed set level which is 8*lr for the duration of the fixed set time which is 200 ms.

Check the circuits including the motor for any insulation fault phase to phase or earth fault.

High current fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
26.07 **High current out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
26.08 **High current op**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manaul

7.17.2.5 Faulty usage fault

Faulty usage fault is activated if the user tries to use motor heating and slow speed functions and the motor is connected inside delta.

Faulty usage fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
26.09 **Faulty usage out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
26.10 **Faulty usage op**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manaul

7.17.2.6 Connection fault

Connection fault signals a fault when a fault connection is detected for both type of connections, in line and inside delta

Connection fault is configured with the following parameters:

Parameter	Description	Setting range	Default value
26.11 **Faulty connection out**	Specifies the Event groups this fault belongs to.	Eventgroup 0 ... 6	1
26.12 **Faulty connecion op**	Sets the operation of this fault.	Stop manual, Stop auto	Stop manaul

7.18   Special feature

This chapter describes features that are available to all users, but beyond the normal range of use for the softstarter.
The features are:

• Line contactor close time

• TOR relay delay time

• Start without start command

• Step down level

• System mode

• Limp mode

• Motor connection

7.18.3   Line contactor close time

This feature allow time for the line contactor to close before the softstarter assumes that it has correct three phase supply.

This is useful to avoid timing problems that can lead to unnecessary trips on for example Phase loss protection.

Line contactor close time is configured with the following parameters:

Parameter	Description	Setting range	Default value
28.02 **Line contactor close time**	Allow time for line contactor to close. Sets the time between start signal and beginning of diagnostic measurements.	0 ... 65535 ms	245 ms

7.18.4   TOR relay delay time
TBD

TOR relay delay time is configured with the following parameters:

Parameter	Description	Setting range	Default value
28.03 **TOR relay delay time**	Set the delay time from Top Of Ramp until the Top Of Ramp relay is activated	0.0 ... 300.0 s	0.0 s

7.18.5   Limp mode

This feature allow the PSTX to operate with only two controlled phases in case of short circuit of one set of thyristors. A warning will be activated (if the short circuit warning is enabled) and the thyristors should be replaced as soon as conveniently possible.

Limp mode is configured with the following parameters:

Parameter	Description	Setting range	Default value
28.41 **Limp mode**	If this parameter is enabled and if a thyristor is shorted, there will be an automatic transition to limp mode.	Off, On	Off

7.18.6 Start without start command

This feature could be used for a customer that would like to use the softstarter in the same way as a contactor is used, i.e. as soon as the control supply to the softstarter is turned on the softstarter will automatically start the motor. No wiring of start and stop signals is needed.

Start without start command is configured with the following parameters:

Parameter	Description	Setting range	Default value
28.04 **Start without start command**	Starts the motor without needing an external start command.	Off, On	Off

7.18.7 Step down level

When the softstarter is given a stop signal the softstarter first decreases the output voltage to the motor in a quick stop ramp, from full voltage down to set Step down voltage level. Then the softstarter controls the output voltage in a stop ramp.

It is only meaningful to adjust the step down level for torque control. When using voltage ramp it shall be set to 80%. Depending on the load it can be necessary to adjust the step down level.

Step down level is configured with the following parameters:

Parameter	Description	Setting range	Default value
28.05 **Step down level**	Set the level from where the stop ramp initiates.	10% ... 100%	80%

7.18.8 System mode

Select between:

- Normal mode
- Demo mode
- Small motor mode

Normal mode
Normal mode is the default setting and is used in all situations except the ones described below.

Demo mode
Demo is used mainly for training purposes to simulate a load condition without having the softstarter connected to main power.

Small motor mode
small motor mode is used for basic testing purposes when using a smaller motor than the PSTX is specified for. The softstarter will be able to start the motor, but some functions and protections are disabled.

System mode is configured with the following parameters:

Parameter	Description	Setting range	Default value
28.40 **System mode**	Sets the run mode.	Normal, Demo, small motor	Normal

7.19   Settings

The settings menu contains softstarter set-up parameters.

- Language

- Date & Time

- Display settings (for HMI)

- Reset from defaults

For settings and navigation, see chapter 6.4.6 Human Machine Interface (HMI).

7.20   Assistants

The Assistants menu contains of predefined settings and parameters. This is should be used if an easy and quick setup is required. Only a few parameters have to be set before start of the motor is possible. All necessary input data will show up in an automatic loop. The Assistants menu is divided in:

- **Basic set-up**

- **Application set-up**

i	After selecting an application and performing the desired tuning, the application should not be selected again. If this is done, all the tuning will be reset to the default settings for the selected application.

Enter the Assistants menu
Find the Assistants menu by pressing right Selection softkey "Menu" and select Assistants with the Navigation keypad. Press the right Selection softkey "Select" to enter the Assistants menu.

Basic set-up
The Basic set-up menu is divided in 5 steps: Language, Date and time, Motor data and System configuration.

Application set-up
The Application set-up i quick settings for Applications, Values and Tune settings. Select what type of application the softstarter is used for by pressing right Selection softkey "Select".

For more detailes in how to set Basic set-up and Application set-up **see chapter 2 Quickstart.**

7.20.1 Table Application settings

		Recommended basic setting						
		Start ramp time	Stop ramp time	Start ramp initial level	Stop ramp end level	Current limit level	Start mode	Stop mode
Normal start (class 10)	Band saw	10	-	30	30	4	Voltage ramp	No ramp
	Bow thruster	10	-	30	30	3	Voltage ramp	No ramp
	Centrifugal pump	10	10	30	30	4	Voltage ramp	Torque ramp
	Circular saw	10	-	30	30	4	Voltage ramp	No ramp
	Conveyor belt short	10	-	40	30	3,5	Voltage ramp	No ramp
	Cutter	10	-	30	30	4	Voltage ramp	No ramp
	Escalator	10	-	30	30	3,5	Voltage ramp	No ramp
	High pressure pump	10	10	40	30	4,5	Voltage ramp	Torque ramp
	Hydraulic pump	10	-	30	30	3	Voltage ramp	No ramp
	Lift/Elevator	10	-	30	30	3,5	Voltage ramp	No ramp
	Piston compressor	5	-	50	30	3	Voltage ramp	No ramp
	Scroll compressor	2	-	50	30	3	Voltage ramp	No ramp
Heavy duty start (class 30)	Axial fan	10	-	30	30	4	Voltage ramp	No ramp
	Conveyor belt long	10	-	40	30	3,5	Voltage ramp	No ramp
	Crusher	10	-	30	30	4	Voltage ramp	No ramp
	Centrifugal fan	10	-	30	30	4	Voltage ramp	No ramp
	Grinder	10	-	30	30	4	Voltage ramp	No ramp
	Mixer	10	-	30	30	3,5	Voltage ramp	No ramp

Note: Use the parameter values above as guidance only.
Additional tuning can be necessary because of variations
in load conditions.

7.21   Complete parameter list

Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
01	**Motor rated current Ie**					
01.01	Motor rated current Ie	9.0 ... 1250.0 A	1	1	9.0 A	
02	**Start and stop**					
02.01	Start mode	Voltage ramp, Torque ramp, Full voltage start	0	2	Voltage ramp	
02.02	Stop mode	No ramp, Voltage ramp, Torque ramp	0	3	No ramp	
02.03	Start ramp initial level	10 ... 99 %	0	4	30 %	
02.04	Start ramp time	1 ... 120 s	0	5	10 s	
02.05	Stop ramp end level	10 ... 99 %	0	6	30 %	
02.06	Stop ramp time	1 ... 120 s	0	7	10 s	
02.07	Pre-start function	Pre start off, Motor heating, Stand still brake Slow speed forward, Slow speed reverse	0	0	Pre start off	
02.08	Pre-start time	0.0 ... 7200.0 s	1	0	10.0 s	
03	**Limit**					
03.01	Current limit type	Off, Normal, Dual, Ramp	0	18	Off	
03.02	Current limit level	1.5 ... 7.5 x I$_e$	1	19	4.0 x I$_e$	
03.03	2nd curr lim level	0.5 ... 7.5 x I$_e$	1	20	7.0 x I$_e$	
03.04	2nd curr lim time	2 ... 120 s	0	21	8 s	
03.05	Torque limit level	20 ... 200 %	0	0	150 %	
04	**Kick start**					
04.01	Kick start	On / Off	0	22	Off	
04.02	Kick start level	50 ... 100 %	0	23	70 %	
04.03	Kick start time	0.2 ... 2.0 s	2	24	0.2 s	
05	**Slow speed**					
05.01	Slow speed forward	Fast jog, Jog, Creep	0	0	Jog	
05.02	Slow speed fwd strenght	10 ... 100 %	0	0	50 %	
05.03	Slow speed reverse	Fast jog, Jog, Creep	0	0	Jog	
05.04	Slow speed rev strength	10 ... 100 %	0	0	50 %	
06	**Motor heating**					
06.01	Motor heating capacity	10 ... 100000 W	0	0	10 W	
07	**Motor braking**					
07.01	Stand still brake strength	10 ... 100	0	0	50 %	
08	**Sequence start**					
08.01	Sequence mode	On / Off	0	8	Off	
08.02	Ie seq 1	9.0 ... 1250.0 A	1	0	9.0 A	
08.03	Start mode seq 1	Voltage ramp, Torque ramp, Full voltage start	0	0	Voltage ramp	
08.04	Start ramp time seq 1	1 ... 120 s	0	0	10 s	
08.05	Start ramp init lvl seq 1	10 ... 99 %	0	0	30 %	
08.06	Curr lim level seq 1	0.5 ... 7.5 x I$_e$	1	0	7.0 x I$_e$	
08.07	Kick start seq 1	On / Off	0	0	Off	
08.08	Kick start level seq 1	50 ... 100 %	0	0	70 %	
08.09	Kick start time seq 1	0.20 ... 2.0 s	2	0	0.20 s	
08.10	Torque lim lvl seq 1	20 ... 200 %	0	0	150 %	
08.11	Torque tune seq 1	0 ... 1000 %	0	0	100 %	
08.12	Torque ctrl gain seq 1	0.01 ... 10.0	2	0	0.02	
08.30	Ie seq 2	9.0 ... 1250.0 A	1	0	9.0 A	
08.31	Start mode seq 2	Voltage ramp, Torque ramp, Full voltage start	0	0	Voltage ramp	
08.32	Start ramp time seq 2	1 ... 120 s	0	0	10 s	
08.33	Start ramp init lvl seq 2	10 ... 99 %	0	0	30 %	
08.34	Curr lim level seq 2	0.5 ... 7.5 x I$_e$	1	0	7.0 x I$_e$	
08.35	Kick start seq 2	On / Off	0	0	Off	
08.36	Kick start level seq 2	50 ... 100 %	0	0	70 %	

Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
08	**Sequence start**					
08.37	Kick start time seq 2	0.20 ... 2.00 s	2	0	0.20 s	
08.38	Torque limit lvl seq 2	20 ... 200 %	0	0	150 %	
08.39	Torque tune seq 2	0 ... 1000 %	0	0	100 %	
08.40	Torque ctrl gain seq 2	0.01 ... 10.00	2	0	0.02	
08.60	Ie seq 3	9.0 ... 1250 A	1	0	9.0 A	
08.61	Start mode seq 3	Voltage ramp, Torque ramp, Full voltage start	0	0	Voltage ramp	
08.62	Start ramp time seq 3	1 ... 120 s	0	0	10 s	
08.63	Start ramp init lvl seq 3	10 ... 99 %	0	0	30 %	
08.64	Curr lim level seq 3	0.5 ... 7.5 x I_e	1	0	7.0 x I_e	
08.65	Kick start seq 3	On / Off	0	0	Off	
08.66	Kick start level seq 3	50 ... 100 %	0	0	70 %	
08.67	Kick start time seq 3	0.2 ... 2.00 s	2	0	0.2 s	
08.68	Torque limit lvl seq 3	20 ... 200 %	0	0	150 %	
08.69	Torque tune seq 3	0 ... 1000 %	0	-	100 %	
08.70	Torque ctrl gain seq 3	0.01 ... 10.0	2	-	0.02	
09	**Automatic restart**					
09.01	Auto-reset delay time	0 ... 3600 s	0	-	0 s	
09.02	Auto-restart	On / Off	0	-	Off	
09.03	Auto-restart max attempts	1 ... 10	0	-	5	
10	**Internal IO**					
10.01	In0 function	None, Reset, Enable, Slow speed forward, Slow speed reverse, Motor heating, Stand still brake, Start reverse, User defined protection, Emergency mode, Fieldbus disable control, Start 1, Start 2, Start 3. *	0	130	Reset	
10.02	In1 function	0 ... 15 *	0	131	None	
10.03	In2 function	0 ... 15 *	0	132	None	
10.04	K4 function	None, Run, Top of ramp, Event group 0, Event group 1, Event group 2, Event group 3, Event group 4, Event group 5, Event group 6, Sequence 1 RUN, Sequence 2 RUN, Sequence 3 RUN, Sequence 1 TOR, Sequence 2 TOR, Sequence 3 TOR, Run reverse **	0	133	Run	
10.05	K5 function	0 ... 17 **	0	134	Top of ramp	
10.06	K6 function	None, Run, Top of ramp, Event group 0, Event group 1, Event group 2, Event group 3, Event group 4, Event group 5, Event group 6, Sequence 1 Run, Sequence 2 Run, Sequence 3 Run	0	135	Event group 0	
10.07	AO reference	0-10 mA, 0-20 mA, 4-20 mA, 0-10 V	0	137	4-20 mA	
10.08	AO type	Motor current [A], Mains voltage [V], Active power [kW], Active power [HP], Reactive power [kVAr], Apparent power [kVA], Active energy [kWh], Reactive energy [kVArh], COS [**COS [Φ**], Motor temperature [%], Thyristor temperature [%], Motor voltage [%] Mains frequency [Hz], PT100 temperature [centigrade], PTC resistance [Ω]	0	138	Motor current [A]	
10.09	AO max value	0.0 ... 1000000.0	0	139	500.0	
10.10	AO min value	0.0 ... 1000000.0	0	140	0.0	
10.11	Ext therm sensor - ID	No sensor, PTC element, Three-wire PT100, Two-wire PT100, Thermistor switch	0	-	No sensor	

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Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
11	**External IO**					
11.01	1DI0 function	None, Reset, Enable, Slow speed forward, Slow speed reverse, Motor heating, Stand still brake, Start reverse, User defined protection, Emergency mode, Fieldbus disable control, Start 1, Start 2, Start 3 ***	0	145	None	
11.02	1DI1 function	0 ... 15 ***	0	146	None	
11.03	1DI2 function	0 ... 15 ***	0	147	None	
11.04	1DI3 function	None, Reset, Enable, Slow speed forward, Slow speed reverse, Motor heating, Stand still brake, Start reverse, User defined protection, Emergency mode, Fieldbus disable control, Start 1, Start 2, Start 3 ***	0	148	None	
11.05	1DI4 function	0 ... 15 ***	0	149	None	
11.06	2DI5 function	0 ... 15 ***	0	150	None	
11.07	2DI6 function	0 ... 15 ***	0	151	None	
11.08	2DI7 function	0 ... 15 ***	0	152	None	
11.09	1DO0 function	None, Run, Top of ramp, Event group 0, Event group 1, Event group 2, Event group 3, Event group 4, Event group 5, Event group 6, Sequence 1 Run, Sequence 2 Run, Sequence 3 Run, Sequence 1 TOR, Sequence 2 TOR, Sequence 3 TOR ****	0	153	4-20 mA	
11.10	1DO1 function	0 ... 15 *** *	0	154	None	
11.11	2DO2 function	0 ... 15 *** *	0	155	None	
11.12	2DO3 function	0 ... 15 *** *	0	156	None	
11.13	1AO0 reference	0-10 mA, 0-20 mA, 4-20 mA, 0-10 V	0	157	4-20 mA	
11.14	1AO0 type	Motor current [A], Mains voltage [V], Active power [kW], Active power [HP], Reactive power [kVAr], Apparent power [kVA], Active energy [kWh], Reactive energy [kVArh], COS [θ], Motor temperature [%], Thyristor temperature [%], Motor voltage [%] Mains frequency [Hz], PT100 temperature [centigrade], PTC resistance [Ω]	0	158	Motor current [A]	
11.15	1AO0 max value	0 ... 1000000	0	159	500	
11.16	1AO0 min value	0 ... 1000000	0	160	0	
12	**Communication**					
12.01	Com3 function	None, Test, Modbus RTU slave. Extension I/O	0	26	Test	
12.02	FB interface connector	FbPlug, Modbus RTU, Anybus, None	0	32	None	
12.03	Fieldbus control	On / Off	0	45	Off	
12.04	Fieldbus address	0 ... 65535	0	51	0	
12.05	Fieldbus IP address	000.000.000.000	0	58	0	
12.06	Fieldbus IP gateway	000.000.000.000	0	59	0	
12.07	Fieldbus IP netmask	255.255.255.000	0	83	4294967040u	
12.08	Fieldbus IP DHCP client	On / Off	0	92	Off	
12.09	FB baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 125000, 250000, 500000, auto	0	185	19200	
12.10	FB parity	No parity, Odd parity, Even parity	0	136	Even parity	
12.11	FB stop bits	1 Stop bit, 2 Stop bits	0	141	1 Stop bit	

Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
12	**Communication**					
12.13	Fieldbus DI 1	None, Start feedback, Stop feedback, Fault reset feedback, Slow speed rev feedback, Slow speed forw feedback, Start 1 feedback, Start 2 feedback, Start 3 feedback, Motor heating feedback, User defined feedback, Stand still brake feedback, Emergency mode feedback, Start reverse feedback, Run status, TOR status, Line, Phase sequence, Event group 0 status, Event group 1 status, Event group 2 status, Event group 3 status, Event group 4 status, Event group 5 status, Event group 6 status, Sequence 1 Run status, Sequence 2 Run status, Sequence 3 Run status, Sequence 1 TOR status, Sequence 2 TOR status, Sequence 3 TOR status, Run reverse status *** **	0	142	Line	
12.13	Fieldbus DI 2	0 ... 32 *** **	0	143	Phase sequence	
12.14	Fieldbus DI 3	0 ... 32 *** **	0	144	Event group 0 status	
12.15	Fieldbus DI 4	0 ... 32 *** **	0	161	Event group 1 status	
12.16	Fieldbus DI 5	0 ... 32 *** **	0	162	Start feedback	
12.17	Fieldbus DI 6	0 ... 32 *** **	0	163	Stop feedback	
12.18	Fieldbus DI 7	0 ... 32 *** **	0	164	Event group 2 status	
12.19	Fieldbus DI 8	0 ... 32 *** **	0	165	Event group 3 status	
12.20	Fieldbus DI 9	0 ... 32 *** **	0	166	Event group 4 status	
12.21	Fieldbus DI 10	0 ... 32 *** **	0	167	Event group 5 status	
12.22	Fieldbus AI 1	None, Phase L1 current, Phase L2 current, Active power (HP), Active power, Apparent power, Mains voltage, Power factor, Motor voltage, Active energy (resettable), EOL time to trip, Mains frequency, Max phase current, Motor current, Motor run time (resettable), Motor temperature, Motor temperature percent, Number of starts (resettable), Phase sequence, PT100 temperature, PTC resistance, Reactive energy (resettable), Reactive power, Remaining time to start, Thyristor temperature, Thyristor temperature percent, EOL time to cool, Top event code, Motor current percent, Thyristor run time (resettable), Motor connection *** ***	0	168	Phase L1 current	
12.23	Fieldbus AI 2	0 ... 32 *** ***	0	169	Phase L2 current	
12.24	Fieldbus AI 3	0 ... 32 *** ***	0	172	Phase L3 current	
12.25	Fieldbus AI 4	0 ... 32 *** ***	0	174	Max phase current	
12.26	Fieldbus AI 5	0 ... 32 *** ***	0	177	Mains frequency	
12.27	Fieldbus AI 6	0 ... 32 *** ***	0	178	Motor voltage	
12.28	Fieldbus AI 7	0 ... 32 *** ***	0	179	Motor temperature percent	
12.29	Fieldbus AI 8	0 ... 32 *** ***	0	180	Number of starts (resettable)	
12.30	Fieldbus AI 9	0 ... 32 *** ***	0	183	Motor run time (resettable)	
12.31	Fieldbus AI 10	0 ... 32 *** ***	0	186	Top event code	

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Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
13	**Protections list 1**					
13.01	EOL mode	Normal, Dual	0	55	Normal	
13.02	EOL class	10A, 10, 20, 30	0	56	10	
13.03	EOL dual class	10A, 10, 20, 30	0	57	10A	
13.04	EOL out	0 ... 127	0	84	0000010	
13.05	EOL operation	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Stop-Manual	
13.06	Locked rotor level	0.5 ... 8.0 x I_e	1	54	4.0 x I_e	
13.07	Locked rotor trip time	0.2 ... 10.0 s	2	53	1.00 s	
13.08	Locked rotor delay time	1.0 ... 30.0 s	2	52	5.00 s	
13.09	Locked rotor out	0 ... 127	0	85	0000010	
13.10	Locked rotor op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
13.11	Max no of starts per hour	1 ... 100	0	0	6	
13.12	Max no of starts per hour out	0 ... 127	0	0	0000010	
13.13	Max no of starts per hour op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
14	**Protections list 2**					
14.01	Curr underload level	0.3 ... 0.9 x I_e	1	0	0.3 x I_e	
14.02	Curr underload trip time	0 ... 10 s	0	0	1 s	
14.03	Curr underload delay time	0 ... 10 s	0	0	10 s	
14.04	Curr underload out	0 ... 127	0	87	0000010	
14.05	Curr underload op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
14.06	Pwr factor underload level	0.0 ... 1.0	2	0	0.70	
14.07	Pwr factor underload trip time	0 ... 10 s	0	0	1 s	
14.08	Pwr factor underload delay time	0 ... 30 s	0	0	10 s	
14.09	Pwr factor underload out	0 ... 127	0	86	0000010	
14.10	Pwr factor underload op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
14.11	Curr imb level	10 ... 80 %	0	61	80 %	
14.12	Curr imb trip time	1 ... 30 s	0	63	10 s	
14.13	Curr imb delay time	1 ... 30 s	0	62	30 s	
14.14	Curr imb out	0 ... 127	0	64	0000010	
14.15	Curr imb operation	Off, Stop-Manual, Stop-Automatic, Indication	0	60	Off	
15	**Protections list 3**					
15.01	Over voltage level	170 ... 850 V	0	67	850 V	
15.02	Over voltage trip time	0.1 ... 100.0 s	1	65	1.0 s	
15.03	Over voltage out	0 ... 127	0	68	0000010	
15.04	Over voltage op	Off, Stop-Manual, Stop-Automatic, Indication	0	66	Off	
15.05	Under voltage level	170 ... 850 V	0	71	170 V	
15.06	Under voltage trip time	0.1 ... 100.0 s	1	69	1.0 s	
15.07	Under voltage op	Off, Stop-Manual, Stop-Automatic, Indication	0	70	Off	
15.08	Under voltage out	0 ... 127	0	72	0000010	
15.09	Voltage imb level	1 ... 100 %	0	77	10 %	
15.10	Voltage imb out	0 ... 127	0	78	0000010	
15.11	Voltage imb op	Off, Stop-Manual, Stop-Automatic, Indication	0	76	Off	
16	**Protections list 4**					
16.01	Phase rev out	0 ... 127	0	89	0000010	
16.02	Phase rev operation	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
16.03	Freq range lower trip lvl	40 ... 72 Hz	0	0	45 Hz	
16.04	Freq range upper trip lvl	40 ... 72 Hz	0	0	66 Hz	
16.05	Freq range trip time	0.0 ... 60.0 s	1	0	1.0 s	
16.06	Freq range out	0 ... 127	0	91	0000010	
16.07	Freq range operation	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
16.08	By-pass open out	0 ... 127	0	95	0000010	
16.09	By-pass open operation	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	

Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
16	**Protections list 4**					
16.10	Voltage outputs out	0 ... 127	0	82	0000010	
16.11	Voltage outputs op	Off, Stop-Manual, Stop-Automatic, Indication	0	81	Off	
17	**Protections list 5**					
17.01	PTC out	0 ... 127	0	88	0000010	
17.02	PTC op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
17.03	PT100 2wire res	0 ... 100.0 Ω	1	0	100.0 Ω	
17.04	PT100 trip temp	-50 ... 250 °C	0	0	60 °C	
17.05	PT100 reset temp	-50 ... 250 °C	0	0	40 °C	
17.06	PT100 out	0 ... 127	0	98	0000010	
17.07	PT100 op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
18	**Protections list 6**					
18.01	User defined DI status	Active low, Active high	0	0	Active high	
18.02	User defined trip time	0.0 ... 60.0 s	1	0	1.0 s	
18.03	User defined out	0 ... 127	0	90	0000010	
18.04	User defined op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
18.05	Earth fault trip time	0.1 ... 1.0 s	1	73	0.5 s	
18.06	Earth fault out	0 ... 127	0	75	0000010	
18.07	Earth fault op	Off, Stop-Manual, Stop-Automatic, Indication	0	74	Off	
18.08	Too long curr lim trip time	1 ... 600 s	0	0	10 s	
18.09	Too long curr lim out	0 ... 127	0	0	0000010	
18.10	Too long curr lim op	Off, Stop-Manual, Stop-Automatic, Indication. Fast ramp	0	0	Off	
19	**Protections list 7**					
19.01	HMI failure out	0 ... 127	0	100	0000010	
19.02	HMI failure op	Off, Stop-Manual, Stop-Automatic, Indication, Switch of HMI control	0	0	Off	
19.03	Fieldbus failure out	0 ... 127	0	97	0000010	
19.04	Fieldbus failure op	Off, Stop-Manual, Stop-Automatic, Indication, Switch to I/O control	0	0	Off	
19.05	Ext IO failure trip time	300 ... 30000 ms	0	-	1000 ms	
19.06	Ext IO failure out	0 ... 127	0	99	0000010	
19.07	Ext IO failure op	Off, Stop-Manual, Stop-Automatic, Indication	0	0	Off	
20	**Warnings list 1**					
20.01	EOL level	40.0 ... 99.0 %	1	181	90.0 %	
20.02	EOL out	0 ... 127	0	123	0000100	
20.03	EOL warning	On / Off	0	182	Off	
20.04	Locked rotor level	0.2 ... 10.0 x I_e	1	0	3.0 x I_e	
20.05	Locked rotor init time	1.0 ... 30.0 s	1	-	1.0 s	
20.06	Locked rotor out	0 ... 127	0	125	0000100	
20.07	Locked rotor	On / Off	0	0	Off	
20.08	Thyristor OL out	0 ... 127	0	124	0000100	
20.09	Thyristor OL	On / Off	0	122	Off	
21	**Warnings list 2**					
21.01	Curr underload level	0.4 ... 1.0 x I_e	1	0	0.4 x I_e	
21.02	Curr underload trip time	0 ... 30 s	0	0	5 s	
21.03	Curr underload delay time	0 ... 10 s	0	0	1 s	
21.04	Curr underload out	0 ... 127	0	126	0000100	
21.05	Curr underload	On / Off	0	0	Off	
21.06	Pwr factor underload level	0.0 ... 1.0	2	0	0.50	
21.07	Pwr factor underload trip time	0 ... 30 s	0	0	5 s	
21.08	Pwr factor underload delay time	0 ... 10 s	0	0	1 s	
21.09	Pwr factor underload out	0 ... 127	0	127	0000100	
21.10	Pwr factor underload	On / Off	0	0	Off	

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Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
21	**Warnings list 2**					
21.11	Current imb level	10 … 80 %	0	102	70 %	
21.12	Current imb out	0 … 127	0	103	0000100	
21.13	Current imbalance	On / Off	0	101	Off	
22	**Warnings list 3**					
22.01	Over voltage level	208 … 850 V	0	104	208 V	
22.02	Over voltage trip time	0.1 … 100.0 s	1	105	1.0 s	
22.03	Over voltage out	0 … 127	0	107	0000100	
22.04	Over voltage	On / Off	0	106	Off	
22.05	Under voltage level	208 … 850 V	0	108	208 V	
22.06	Under voltage trip time	0.1 … 100.0 s	1	109	1.0 s	
22.07	Under voltage out	0 … 127	0	111	0000100	
22.08	Under voltage	On / Off	0	110	Off	
22.09	Voltage imb level	1 … 100	0	119	5	
22.10	Voltage imb out	0 … 127	0	120	0000100	
22.11	Voltage imbalance	On / Off	0	118	Off	
23	**Warnings list 4**					
23.01	EOL time-to-trip time	1 … 1000 s	0	114	5 s	
23.02	EOL time-to-trip out	0 … 127	0	112	0000100	
23.03	EOL time-to-trip	On / Off	0	113	Off	
23.04	THD(U) level	1 … 100 %	0	116	10 %	
23.05	THD(U) out	0 … 127	0	117	0000100	
23.06	THD(U)	On / Off	0	115	Off	
23.07	Short circuit out	0 … 127	0	129	0000100	
23.08	Short circuit	On / Off	0	121	Off	
24	**Warnings list 5**					
24.04	Faulty fan out	0 … 127	0	80	0000100	
24.05	Faulty fan	On / Off	0	79	Off	
24.06	Modbus_RTU w/o auxport out	0 … 127	0	176	0000100	
25	**Internal faults**					
25.01	Shunt fault out	0 … 127	0	42	0000001	
25.02	Shunt fault op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
25.03	Short circuit out	0 … 127	0	50	0000001	
25.04	Short circuit fault op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
25.05	Open circuit thyr out	0 … 127	0	44	0000001	
25.06	Open circuit thyr op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
25.07	Thyristor OL out	0 … 127	0	47	0000001	
25.08	Thyristor OL op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
25.09	Heat sink over temp out	0 … 127	0	48	0000001	
25.10	Heat sink over temp op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
25.11	Unspecified fault out	0 … 127	0	43	0000001	
25.12	Unspecified fault op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
26	**External faults**					
26.01	Phase loss out	0 … 127	0	96	0000001	
26.02	Phase loss op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
26.03	Bad network out	0 … 127	0	36	0000001	
26.04	Bad network op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
26.05	Low supply voltage out	0 … 127	0	46	0000001	
26.06	Low supply voltage op	Stop-Manual, Stop-Automatic	0	-	Stop-Manual	
26.07	High current out	0 … 127	0	49	0000001	
26.08	High current op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
26.11	Faulty connection out	0 … 127	0	-	0000001	
26.12	Faulty connection op	Stop-Manual, Stop-Automatic	0	0	Stop-Manual	
27.01	Language	English, Spanish, Finnish, French, Italian Dutch, Polish, Portuguese, Russian, Swedish Turkish, Chinese (simplified chinese), Arabic Czech, German	0	173	English	
27.02	Basic set-up at power on	Yes, No	0	-	Yes	

Parameter number	Description	Setting range	Number of decimal	Fieldbus ID	Default value	Actual setting
28	**Service**					
28.01	ID	Invalid ID, 30, 37, 45, 60, 72, 85, 105, 142, 170, 210, 250, 300, 370, 470, 570, 720, 840, 1050, 1250	0	171	Invalid ID	
28.02	Line contactor close time	0 ... 65535 ms	0	175	245 ms	
28.03	TOR relay delay time	0 ... 300 s	1	-	0 s	
28.04	Start without start command	On / Off	0	-	Off	
28.05	Step down level	10 ... 100 %	0	9	80 %	
28.06	Torque profile start	Constant setpoint, Linear ramp, Progressive curve, High inertia curve	0	10	Linear ramp	
28.07	Torque finish	30 ... 500 %	0	17	100 %	
28.08	Torque tune	0 ... 1000 %	0	11	100 %	
28.09	Torque ctrl gain	0.01 ... 10.00	2	12	0.02	
28.10	Torque PI intergration time	0.001 ... 10 s	3	13	0.004 s	
28.11	Torque slip	0.1 ... 100 %	1	14	1.0 %	
28.12	Torque diff	0.1 ... 100 %	1	15	2.0 %	
28.13	Torque filter time	0.01 ... 100 s	2	16	0.02 s	
28.14	Mains lock setting	Automatic lock, 50 Hz manual lock 60 Hz manual lock	0	-	Automatic lock	
28.15	Minimum trig time	0.0 ... 1.0 ms	3	-	0.208 ms	
28.16	Accel adapt U start ramp	On / Off	0	-	Off	
28.17	U start ramp switch level	10 ... 100 %	0	-	22 %	
28.18	T start ramp switch level	10 ... 100 %	0	-	30 %	
28.19	Stop ramp switch level	10 ... 100 %	0	-	52 %	
28.20	In-Line gain	0.0 ... 30.0	1	-	0.0	
28.21	Inside delta gain	0.0 ... 30.0	1	-	3.0	
28.22	Phase loss	On / Off	0	33	On	
28.23	Phase loss during TOR	On / Off	0	-	On	
28.24	Phase loss trip time	20 ... 4000 ms	0	34	500 ms	
28.25	Phase loss trip angle 1	1 ... 240	0	-	12	
28.26	Phase loss trip angle 2	1 ... 240	0	0	70	
28.27	Bad network quality	On / Off	0	35	On	
28.28	Low supply voltage	On / Off	0	37	On	
28.29	High current fault	On / Off	0	38	On	
28.30	Shunt fault	On / Off	0	40	On	
28.31	Short circuit thyristor	On / Off	0	39	On	
28.32	Open circuit thyristor	On / Off	0	-	On	
28.33	Thyristor overload	On / Off	0	41	On	
28.34	Heat sink over temp	On / Off	0	-	On	
28.35	Faulty connection	On / Off	0	-	On	
28.36	Faulty usage	On / Off	0	-	On	
28.37	Close bypass curr lvl	0.5 ... 4.0 x I_e	1	28	1.2 x I_e	
28.38	Simulation motor	M3AA 100L 2 (Ie = 5.2 A), M3BP 112M 4 (Ie = 7.4 A), M2AA 180MLA 6G (Ie = 29.3 A), M2AA 180MLB 4G (Ie = 39.9 A), M3AA 250SMA 8 (Ie = 62.3 A), M3AA 200MLB 2 (Ie = 59.2 A), M2AA 225SMA 2G (Ie = 74.7 A), M2BP 250SMA 4G (Ie 96.6 A), M2BA 280SMB 2L (Ie = 144.9 A), M2BA 315SMB 4L (Ie = 221.8 A), M2BA 315MLA 2L (Ie = 319.6A), M4BP 200MLB 2G (Ie = 59.3 A), M3BP 315LKB 4K (Ie = 330.4 A), M3BP 315MLA 2M (Ie = 255.4 A),M3BP 280MLA 4M (Ie 151.5 A), M3BP 355SMC 6K (Ie = 325.6 A),	0	29	M3AA 250SMA 8 (Ie = 62.3 A)	
28.39	Simulation load	No load, Linear Load, Progressive load, High inertia load	0	30	Progressive load	
28.40	Simulation connection	Auto, In line, Inside delta UI, Inside delta IU, Two phase (L1 shorted), Two phase (L2 shorted), Two phase (L2 shorted), Unknown	0	-	In line	
28.41	System mode	Normal, Demo, Small motor	0	31	Normal	
28.42	Limp mode	On / Off	0	25	Off	
28.43	Motor connection	Auto, In line, Inside delta UI, Inside delta IU, Two phase (L1 shorted), Two phase (L2 shorted), Two phase (L2 shorted), Unknown	0	27	Auto	

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8   Communication

8

8.1 Built in modbus RTU

The PSTX Softstarter has an RS485 physical interface, to be able to support external devices that have support for RS485 based communication.

With this interface it is possible to control the softstarter, retreive status information, as well as upload and download parameters.

The softstarter has a Modbus RTU slave implemented via the RS485 interface.

8.2 Anybus CompactCom (option)

The PSTX Softstarter has an interface on the front for connecting the Anybus CompactCom (CC) module, used for fieldbus communication. Through this interface it is possible to control the softstarter, retreive status information, as well as upload and download of parameters.

8.2.1 Instructions

Instructions for the set-up of input and output telegrams, parameter settings, instructions, etc. are available at ABB Website.

- DeviceNet   1SFC132084M0201
- Profibus (DPV0/DPV1) 1SFC132085M0201
- Modbus RTU   1SFC132086M0201
- Modbus TCP   1SFC132087M0201
- EtherNet/IP   1SFC132088M0201

8.2.2 Required accessories

The following Anybus CC connection devices are available:

- DeviceNet
- Profibus (DPV0/DPV1)
- Modbus RTU
- Modbus TCP
- EtherNet/IP

8.3 ABB Fieldbus plug interface (option)

The PSTX Softstarter has an interface on the front for connecting the ABB Fieldbus Plug Adapter (FBPA) used for fieldbus communication.

With this interface it is possible to control the softstarter, retreive status information, as well as upload and download parameters.

The interface between the softstarter and the FieldBusPlug is independent of the fieldbus protocol used. Independent of softstarter size or delivery date, it is possible to connect any of the available Fieldbus protocols later on, since this is defined in the FieldBusPlug itself.

The fieldbus communication plug shall be connected to the communication interface on the front of the PST. Make sure that the plug is in correct position and tighten the screw with 0,8 Nm (7,1 lb in) and additional 1/4 turn.

The following Fieldbus protocols are available:

- DeviceNet
- Profibus (DPV0/DPV1)
- Modbus RTU
- PC

8.3.1 Instructions

Instructions for the set-up of input and output telegrams, parameter settings, instructions, etc. are available at ABB Website.

- DeviceNet   1SFC132090M0201
- Profibus (DPV0/DPV1) 1SFC132091M0201
- Modbus RTU   1SFC132092M0201

8.3.2 Required accessories

To connect the PSTX Softstarter to a fieldbus system, the following accessories are required:

- ABB Fieldbus Plug Adapter, for presenting fieldbus protocol (check that the cable length is sufficient).
- Connectors for bus connection.
- End plug (some protocols).
- Software for PLC set-up.

8.4 Mini USB interface

The PSTX Softstarter has an USB interface, to be able to support communication with external devices such as PCs. The USB interface is located on the front of the detachable HMI.

With this interface it is possible to control the softstarter, retreive status information, as well as upload and download parameters.

The USB port is located at the bottom of the HMI.

8

9 Maintenance

9

This chapter describes basic maintenance for the PSTX Softstarter.

⚠️ **CAUTION**

Make sure that the softstarter is de-energized before preforming maintenance.
Do not open the softstarter or touch any live parts when the main and supply voltage is connected.

⚠️ **CAUTION**

Hazardous voltage: Can cause death or serious injury. Turn off and lock out all power that supply this device before you start work on the equipment.

ℹ️ **INFORMATION**

ABB personell have to obey the instructions in ABB CISE 15.4.

ℹ️ Service and repair should be performed by authorized personnel only. Note that unauthorized repair affects saftey and warranty.

9.1   Regular maintenance

- CAUTION! Make sure that the softstarter is de-energized before checking the connections.

- Check that all mounting bolts/screws are fastened.

- Check that all connections of main, control- and supply circuits are fastened.
  For tightening torques, **see chapter 5.1.1.1 Tightening torques and cable dimensions**.

- Tighten the terminal screws and bolts on the connection bars, if needed.
  For tightening torques, **see chapter 5.1.1.1 Tightening torques and cable dimensions**.
  CAUTION! Make sure that the softstarter is de-energized before tightening the bolts/screws.

- Check that the cooling airways are free from dirt and dust.
  CAUTION! Do not use pressurized air to clean.

- If the softstarter is mounted inside a cabinet, check external filters. Clean, if needed.

- Check that the fan is working and rotating freely. The blades shall rotate without any resistance. This can be checked at voltage free state.

- Check the Real Time Clock and adjust if necessary.

- In case of a fault, or if a fault can not be reset, see chapter 10.

9.2   Service and repair

In case the PSTX Softstarter has to be repaired, contact your ABB reseller/Office or contact ABB via Website.

⚠️ **CAUTION**

Make sure that the softstarter is de-energized before preforming maintenance.
Do not open the softstarter or touch any live parts when the main and supply voltage is connected.

⚠️ **CAUTION**

Hazardous voltage: Can cause death or serious injury. Turn off and lock out all power that supply this device before you start work on the equipment.

ℹ️ **INFORMATION**

ABB personnel have to obey the instructions in ABB CISE 15.4.

ℹ️ Service and repair should be performed by authorized personnel only. Note that unauthorized repair affects saftey and warranty.

⚠️ **CAUTION**

In the event of a short circuit on the load side of a softstarter, the device could be completely destroyed and possibly cause danger to personnel. By using a correctly rated short circuit protection device, e.g. a fuse or a circuit breaker, the damage will be limited to one of the two categories, defined in IEC 60947-4-2 and EN 60947-4-2:

Type 1: The softstarter might be damaged and some or all parts might need to be replaced.

Type 2: The device should be operable after the event of a short circuit.

Type 2 coordination is achieved by using a semiconductor fuse. A coordination table is found in the catalogue and online via ABB Website.

To be able to claim warranty for any damage on the thyristors, the coordination type 2 must be achieved.

10 Troubleshooting

10

10.1   General

This chapter is a guide that can be used in case problems would occur with the softstarter or the application.

⚠ **CAUTION**

Hazardous voltage: Can cause death or serious injury. Turn off and lock out all power that supply this device before you start work on the equipment.

⚠ **CAUTION**

Make sure that the softstarter is de-energized before performing maintenance.
Do not open the softstarter or touch any live parts when the main and supply voltage is connected.

ℹ ABB personell have to follow the **ABB CISE 15.4** instructions

The softstarter normally indicates a fault with LED Fault, and the display shows which type of fault that has occurred.
When a protection is activated it will be indicated with LED Protection and the display shows what type of protection which is active.
When a warning occurs, the type of warning will be shown in the display.
Issues like i.e. humming sounds which are not displayed by the softstarter can also be found in this chapter.

10.2   Troubleshooting

Table 1   Troubleshooting

Status	Possible cause	Solution
Motor humming / starts without given start signal.	By-pass relay closed, due to inaccurate handling. (PSTX30...170 only).	• Switch off operational voltage, control supply voltage and remove USB cable from the computer if connected. Switch on voltage in correct succession. 1. Control supply voltage on terminals 1 and 2. See **chapter 5.1.2 Control supply and control circuit**. 2. Wait 4 seconds, and then switch on operational voltage on terminals L1, L2 and L3. • If same fault remains, contact your ABB Sales Office..
	By-pass contactor/relay stuck in closed position.	• Contact your ABB Sales Office.
	Shorted thyristor.	• Contact your ABB Sales Office.
Bad motor sound during start.	The motor connection is not correct.	• Check and correct the wiring. Connect the control supply voltage according to the circuit diagram. See **chapter 11 Wiring diagrams.**
	Incorrect ramp time for start.	• Try different ramp times (some adjustments can be necessary for best result). **See chapter 7 Functions.**

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Status	Possible cause	Solution
Bad motor sound during start.	Incorrect Initial/End level.	• Try different settings for the parameter Initial /End Voltage. **See chapter 7 Functions**, or contact your ABB Sales Office.
	Incorrect Current limit level or Torque limit level.	• Try different settings for the parameter Current limit level or Torque limit level. **See chapter 7 Functions**, or contact your ABB Sales Office.
	The motor is too small. (Current is out of measuring range.)	• Check that the softstarter corresponds to the motor size. • For test purposes it is possoble to use small motor mode. **See chapter 7 Functions**.
	Thyristor not conducting properly.	• Contact your ABB Sales Office.
	Incorrect ramp time for stop.	• Try different ramp times for stop (some adjustments can be necessary for best result). **See chapter 7 Functions.**
	Start and stop command given at the same time.	• Check that start and stop command is not given at the same time.
	The Operational voltage is below 175 V.	• Check the Operational voltage.
Motor does not start when given start command by the hardwire inputs.	Control wiring is not correct. Start and stop command given at the same time. Keypad is in Local control mode.	• Check connections for start and stop. • Check that start and stop command is not given at the same time. • Check that the keypad is not in Local Control mode. Press the R\L-key to change to Remote Control mode. • Check that parameter Fieldbus control is set to No. • Perform a reset on any active event. Reset tripping events.
Motor does not start with fieldbus.	Softstarter has tripped on fault or protection.	• Perform a reset on any active event. Reset tripping events.
	Softstarter is in Local mode.	• Check that the Stop bit of the binary output telegram setting is set to 1. • Verify that parameters are matching between the PLC and the softstarter fieldbus documentation for the fieldbus protocol used. • Check that the Auto mode bit of the binary output telegram setting is set to 1. • Check if the HMI is set to remote mode. • Check that the Local Mode digital input on the ABB FieldBusPlug adapter is set to Remote. • Check that Fieldbus disable control in DI is not connected. • Check that the Fieldbus control parameter is set to On.
	Fieldbus operation when fault parameter is set to Switch to I/O control.	• If the parameter Fieldbus failure op is set to Switch to I/O control when fault occurs, there will be a 10 seconds delay before it is possible to re-start after communication is re-established.

Status	Possible cause	Solution
Loading of parameters with fieldbus does not work properly.	Fieldbus settings.	• Verify that parameters match between the PLC and the softstarter fieldbus documentation for the fieldbus protocol used. Check that the Auto mode bit of the binary output telegram setting is 1. • Check if the HMI is set to remote mode. • Check that the Local Mode digital input on the ABB FieldBusPlug adapter is set to Remote. • Check that Fieldbus disable control in DI is not connected. • Check that the Fieldbus control parameter is set to On.
Displayed phase currents in screen does not correspond to motor current.	Inside Delta connection.	• If the softstarter is connected Inside Delta, the phase currents displayed are = 58% ($1/(\sqrt{3})$) of the motor current.
Displayed current in screen is not stable.	The motor is too small. The load on the motor is too small. (Current is out of measuring range.)	• Check that the softstarter corresponds to the motor size.
Dark screen and LED is active	Power save mode.	• Touch any key on the keypad.
Blank screen and no LED is active	Supply voltage is not connected.	• Connect the Supply voltage according to the circuit diagram. • If problem stays, contact your ABB Sales Office.
	• The RJ45 plug is missing between the HMI and the softstarter. • RJ45 Network cable is damaged.	• Check the RJ45 plug. • Check the RJ45 Network cable

10.3 Overview of faults, protections and warnings

This table shows in which state the different indications
for protections, faults and warnings may show up.

		Motor control states *									
		Stand by	Start prerequisites	Pre-start	Init start	Start Ramp	Close bypass	Top of ramp	Open bypass	Stop ramp	Separate func
Protections	EOL protection	X	X	X	X	X	X	X	X	X	X
	Locked rotor protection							X			
	Phase reversal protection	X	X	X	X	X	X	X	X	X	X
	Current imbalance protection							X			
	Over voltage protection							X			
	Under voltage protection							X			
	Earth fault protection		X	X	X	X	X	X	X	X	X
	Voltage imbalance protection	X	X	X	X	X	X	X	X	X	X
	Voltage outputs protection	X	X	X	X	X	X	X	X	X	X
	External thermal sensor - PT100 protection	X	X	X	X	X	X	X	X	X	X
	External thermal sensor - PTC protection	X	X	X	X	X	X	X	X	X	X
	Power factor underload protection							X			
	Current underload protection							X			
	User defined protection	X	X	X	X	X	X	X	X	X	X
	Too long current limit protection				X	X					
	By-pass open protection							X			
	Fieldbus failure protection	X	X	X	X	X	X	X	X	X	X
	Extension IO failure protection	X	X	X	X	X	X	X	X	X	X
	HMI failure protection	X	X	X	X	X	X	X	X	X	X
	Limit number of starts		X								
Faults	Phase loss fault			X	X	X	X	X	X	X	X
	High current fault	X	X	X	X	X	X	X	X	X	X
	Low supply voltage fault	X	X	X	X	X	X	X	X	X	X
	Bad network fault			X	X	X				X	
	Thyristor overload fault	X	X	X	X	X	X	X	X	X	X
	Short circuit fault	X		X	X	X				X	
	Shunt fault	X		X	X				X	X	
	Unspecified fault			X	X	X				X	
	Heat sink overtemperarure fault	X	X	X	X	X	X	X	X	X	X
	Open circuit thyristor fault		X	X	X	X				X	
	Faulty usage				X						
	Faulty connection				X						
Warnings	Current imbalance warning							X			
	Over voltage warning							X			
	Under voltage warning							X			
	EOL time-to-trip warning	X	X	X	X	X	X	X	X	X	X
	EOL warning	X	X	X	X	X	X	X	X	X	X
	Total Harmonic Distortion (THD) warning							X			
	Voltage imbalance warning	X	X	X	X	X	X	X	X	X	X
	Power factor underload warning							X			
	Current underload warning							X			
	Faulty Fans warning	X	X	X	X	X	X	X	X	X	X
	Locked rotor warning							X			
	Thyristor overload warning	X	X	X	X	X	X	X	X	X	X
	Short circuit warning	X		X	X	X				X	

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* For motor control states description, see chapter 7 Functions

10.4   Protection indication shown on screen

For Protections description, **see chapter 7.19 Protections group 0-6.**

Table 2   Protection indication

Status	Possible cause	Solution
EOL Protection	The motor has been exposed to an overload condition because the current over a certain time is too high. (The load on the motor shaft is too high)	**In Line / Inside Delta** **At start** • Check starting conditions and EOL settings. • Check and correct the reason for the overload. • Check that Current limit level is not set too low. • Check that the ramp time for start is not too long. • Check that correct overload class is used. • Check that parameter Setting I_e is correct.
		Continuous run • Check the rating of the plate for Ie. • Check operational voltage. • Chose a motor with more power, and a softstarter rated for higher current. • Check and correct the reason for the overload. • Check that correct EOL Class is used.
Locked rotor protection	The motor is running stiff by some reason. A damaged bearing or a stuck load could be possible causes.	• Check the bearings of the motor and load. • Check that the load is not running stiff.
Phase reversal protection	The phase sequence is not correct. Current imbalance between the phases.	• Change the phase sequence on the line side to (L1-L2-L3). • Restart the motor and check the main currents and voltage.
Current imbalance protection	Current imbalance between the phases.	• Restart the motor and check the main currents and voltage.
Over voltage protection	The main voltage is to high.	• Check the main voltage.
Under voltage protection	The main voltage is to low.	• Check the main voltage.
Earth fault protection	Equipment protection. In a symmetrical three phase system, the sum of the instantaneous line currents is equal to zero. Earth fault indicates if the sum differs more than a settable value. This can indicate a serious condition of the motor.	• Check motor cables. • Check the motor.
Voltage imbalance protection	Voltage imbalance between the phases.	• Check the main voltage and restart the motor.
Voltage outputs protection	The 24V voltage outputs has been overloaded or shorted.	• Check the connections.
External thermal sensor - PTC protection - PT100 protection	The external thermal sensor has detected a temperature higher than the trip level in the motor or PT100.	• Check the root cause of the over heating. • Check that the PTC or PT100 circuit is closed and that the inputs are connected. • Check and correct the reason for the over temperature. • Wait for the motor to cool sufficiently and restart.
Power factor underload protection	The power factor has fallen below the normal level.	• Check and correct the reason for the underload.

Status	Possible cause	Solution
Current underload protection	The motor current has fallen below the settable value.	• Check and correct the reason for the underload. • Check that the motor current parameter (Ie) is set correctly.
User defined protection	Programmable digital input can be used in combination with external device/sensor to provide to the user the possibility of handling own defined protection.	• Set the programmable input signal to inactive state before resetting the protection event.
Too long current limit protection	The time at current limit has exceeded the set value. The starting condition is too heavy for the set current limit.	• Check starting conditions and parameters.
By-pass open protection	By pass contactor or relay does not close when reached TOR.	• Check and contact your ABB sales office.
Fieldbus failure protection	There is a communication disturbance between the softstarter and PLC.	• Check that the fieldbusplug is connected correctly. • Check that correct type of fieldbusplug is used. • Check that the parameter Fieldbus Type is set according to the present fieldbus type.
Extension I/O failure protection	There is communication disturbance between the softstarter and the extension I/O module.	• Check and correct the connections.
HMI failure protection	There is communication disturbance between the softstarter and the HMI.	• Check and correct the connections.
	The HMI has been removed.	• Place back the HMI again.
Limit number of starts	The softstarter has exceeded the pre-set limited number of starts.	• Wait for the next start interval. For parameter setting, **see chapter 7 Functions.**

10.5 Fault indication shown on screen

For Faults description, **see chapter 7.21 Faults (26) Internal faults (27) External faults**

Table 3 Fault indication

Status	Possible cause	Solution
Phase loss fault	Voltage to one or more phases is missing.	• Check that the mains are connected and that no line contactor or breaker is open.
	Fuse is blown.	• Check and replace fuses for all three phases.
	Power loss on operational current for one or several phases.	• Check and correct operational network supply.
	The line contactor or circuit breaker is open.	• Check and close contactor/breaker or any external switch device.
	Line contactor opens too quickly at stop.	• Control Line contactor with Run signal relay on terminal 4. See **5.1.2.5 Programmable output relay - K4, terminals 4, 5 and 6.** • Add a time relay before contactor opens. • If Stop Ramp not is needed, set Stop mode to direct stop.
High current fault	A fault current, higher than 8 times the softstarter rated current, has occurred.	• Check the circuits, including the motor for any insulation fault phase to phase or earth fault.
Low supply voltage fault	The control supply voltage is too low on terminals 1 and 2.	• Check for voltage dips or interruptions and correct control supply voltage.
	Short power loss on the control supply network.	• Check control supply network for short interruptions.

Status	Possible cause	Solution
Bad network fault	Excessive disturbances in the operational supplying network.	• Check for harmonics or frequency disturbancein the supply network and correct supplying operational network.
	Short power loss on all three phases in the operational network.	• Check and correct supplying operational network.
Thyristor overload fault	The thyristors are overheated.	• Check the starting conditions and the fans. • Decrease current limit if possible. • Let the thyristors cool down before restart.
Short circuit fault	One or several thyristors are shorted.	• Check and contact your ABB sales office for replacement kit.
Shunt fault	The softstarter can not stop the motor due to internal short circuit.	• Contact ABB sales office for service.
	By-pass relay closed, due to inaccurate handling. (PSTX30...170 only).	• Switch off operational voltage and control supply voltage. Switch on voltage in correct succession. 1. Control supply voltage on terminals 1 and 2. See **chapter 5.1.2 Control supply and control circuit.** 2. Wait 4 seconds, and then switch on operational voltage on terminals L1, L2 and L3. • If same fault remains, contact your ABB Sales Office.
Unspecified fault	N/A	• Disconnect and reconnect the supply voltage (Us) and make a restart. • If same fault remains, contact your ABB sales office.
Heat sink fault	The heat sink temperature is too high. If the fault remains after reset, the heat sink is too warm and needs to cool down.	• Check that the fans are working in a proper way. • Check that cooling airways are free from dirt and dust. • Check that the ambient temperature is not too high.
Open circuit thyristor fault	One or several thyristors are not conducting.	• Contact your ABB sales office for service.
	The Operational voltage is below 175 V.	• Check that the softstarter corresponds to the motor size.
	The motor is too small. (Current is out of measuring range.)	• For test purposes it is possoble to use small motor mode. **See chapter 7 Functions.**
Faulty usage	Inside delta motor connection when trying to jog forward, jog backward, heat motor or doing stand still break.	• Do not use named functions with Inside delta motor connection.
Faulty connection	Motor connection unknown when trying to start motor.	• Check motor connection.

10.6 Warning indication shown on screen

For Warnings description, **see chapter 7.20 Warnings group 0-4**.

Table 4   Warning indication

| Status	Cause/Possible cause
Current imbalance warning	Current imbalance between the phases has exceeded the warning level.
Over voltage warning	The RMS phase to phase voltage has exceeded the adjustable value.
Under voltage warning	The RMS phase to phase voltage has decreased below the adjustable value.
EOL time-to-trip warning	The predicted time before EOL trip has reached the warning level.
EOL warning	The calculated motor temperature has exceeded the warning level.
Total Harmonic Distortion (THD(U)) warning	THD(U) has exceeded the warning level. Check the quality of the network.
Voltage imbalance warning	Voltage imbalance between the phases has exceeded the warning level.
Power factor underload warning	The power factor has decreased below the adjustable value during continuous operation.
Current underload warning	The motor current has fallen below the warning level.Check that the motor current parameter (Ie) is set correctly.
Faulty fan warning	The fans are not working properly because dust or mechanical blocking The sofstarter could be overheated. Check that the fans are working and rotating freely. The blades shall rotate without any resistance. ⚠ **CAUTION** The fans may only be checked when in voltage free state. If the fault remains, contact ABB sales office.
Locked rotor warning	The motorcurrent has exceeded the warning level. A damaged bearing or a stuck load could be possible causes.
Thyristor overload warning	The calculated thyristor temperature has exceeded the warning level.
Short circuit warning	There is an internal short circuit and the softstarter is running in limp mode. **See chapter 7 Functions.**

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11 Wiring diagrams

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11.1 Circuit diagram PSTX

11.1.3 Circuit diagram PSTX30...PSTX170 (IEC version)

⚠️ **CAUTION**

Terminal 22 ⏚ is a function earth, it is not a protective earth. It shall be connected to the mounting plate
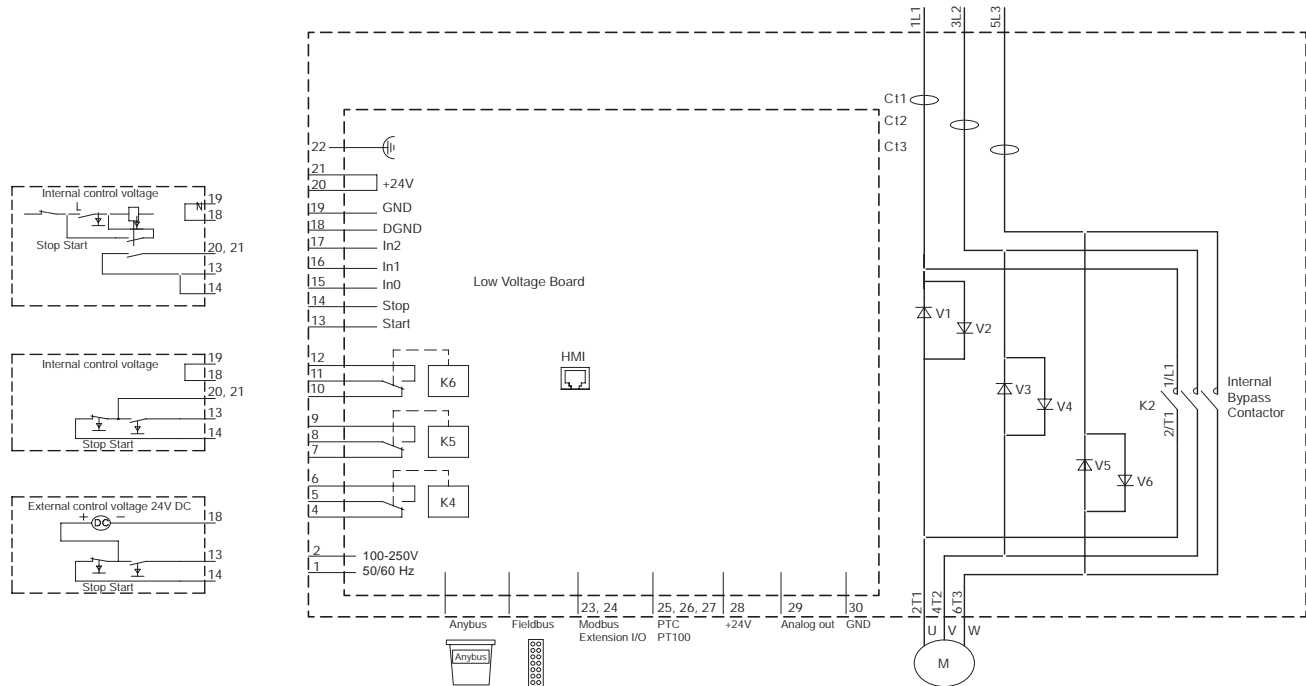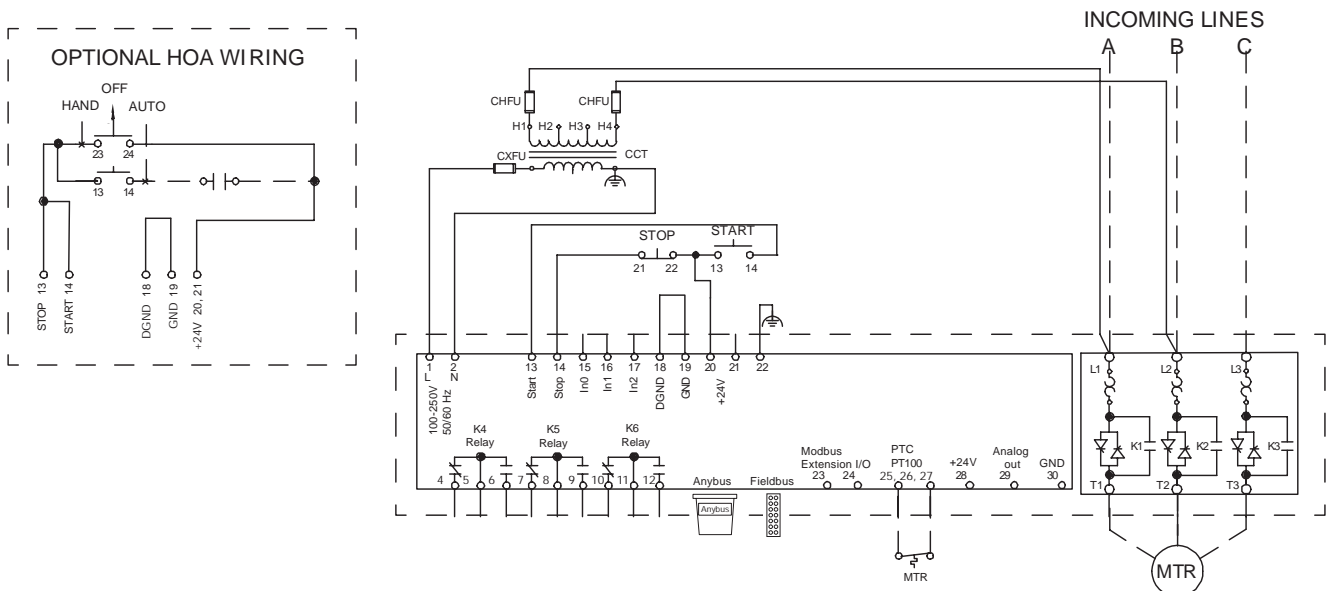

11.1.4 Circuit diagram PSTX30...PSTX170 (UL version)

⚠️ **CAUTION**

Terminal 22 ⏚ is a function earth, it is not a protective earth. It shall be connected to the mounting plate

12 Revisions

The following revisions is done on this document:

Document number	Revision	Chapter	Description	Date
1SFC132081M0201	A	-	First release	2014-06-27